Draft Environmental Impact Statement

on the

Proposed Mining and Reclamation Plan

for Westmoreland Resources, Inc.

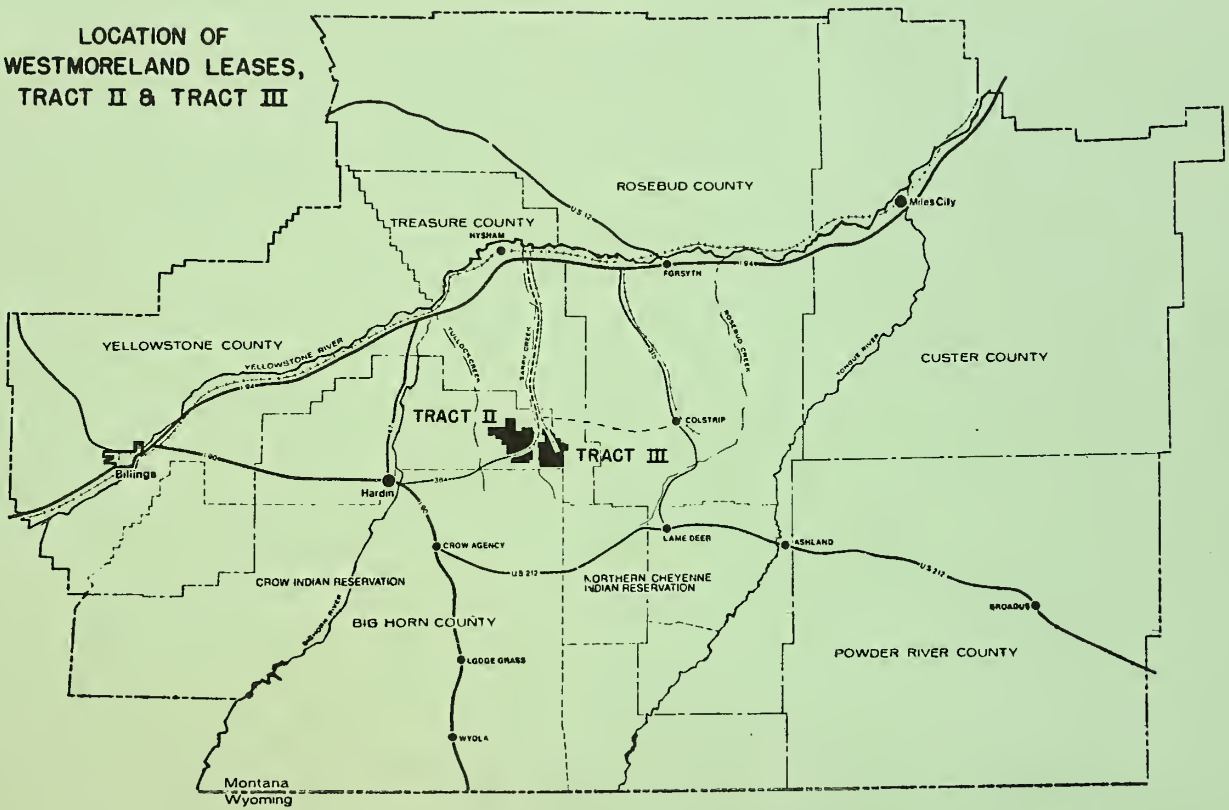
ABSALOKA MINE

Big Horn County, Montana

Montana Department of State Lands

Helena, Montana

LOCATION OF WESTMORELAND LEASES, TRACT II & TRACT III



Source : Mountain West Research Inc.

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Big Horn County, Montana

Prepared by the Montana Department of State Lands

Pursuant to the Montana Environmental Policy Act

September 14, 1979

Leo Berry, Jr., Commissioner
Montana Department of State Lands

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CHAPTER I

DESCRIPTION OF THE PROPOSAL UNDER CONSIDERATION

A. SCOPE OF THE ANALYSIS

Westmoreland Resources, Inc. has applied to the Montana Department of State Lands for a strip-mining permit for its Absaloka mine on Sarpy Creek in Big Horn County, Montana. (See inside front cover and figure I-1.) The permit, which is required under the Montana Strip and Underground Mine Reclamation Act, would allow the company to continue mining on its Tract III lease in the Crow ceded area through 1984 at a rate of 5 million tons/year (mty). Westmoreland will also mine coal under an existing permit from a State-owned section immediately south of the existing operations in Tract III; total coal production from the Absaloka mine would reach 10 mty by 1984.

The Commissioner of the Montana Department of State Lands must decide whether to approve or deny the permit application; if he approves the application, he must decide what stipulations to place on the permit. Because Westmoreland's proposal has the potential to significantly affect the quality of the human environment, the Commissioner's decision on the permit application requires an environmental impact statement (EIS) under the Montana Environmental Policy Act. The Department's Reclamation Division has also reviewed the application and has outlined some concerns in a letter to Westmoreland. (See appendix A.)

Westmoreland plans to mine 200 million tons of coal from the Absaloka mine between 1980 and 2000 at a maximum rate of 10 mty. About 24 million tons of this total would come from the 5-year permit application area from 1980 through 1984; 146 million tons would come from other Tract III lands from 1984 through 2000; and 30 million tons would come from State-owned Section 36, T. 1 N., R. 37 E. south of the existing operations. Figure I-1 shows the projected sequence of mining in Tract III and Section 36. Table I-1 shows the area involved in the permit application, projected employment, mine life, and other statistics.

Chapter III discusses the environmental impacts of a 10 mty production level from 1984 to 2000 (table I-3); where possible, impacts due to mining within the five-year permit application area in Tract III from 1980 through 1984 are highlighted.

Environmental impacts from the Absaloka mine are assessed in the context of other existing and projected coal-related development in southeastern Montana. (See table I-2.) The mines near Decker in southern Big Horn County, along with the Absaloka mine, contribute to the taxable valuation in that county, and are considered primarily in the discussion of economics. The mines near Colstrip in Rosebud County add to coal train traffic along the Burlington Northern rail line east from Montana, and thus would add to traffic due to the Absaloka mine; this cumulative impact is considered in the discussion of tranportation. Other interactions between the Absaloka mine and the mines shown in table I-2 are analyzed where appropriate.

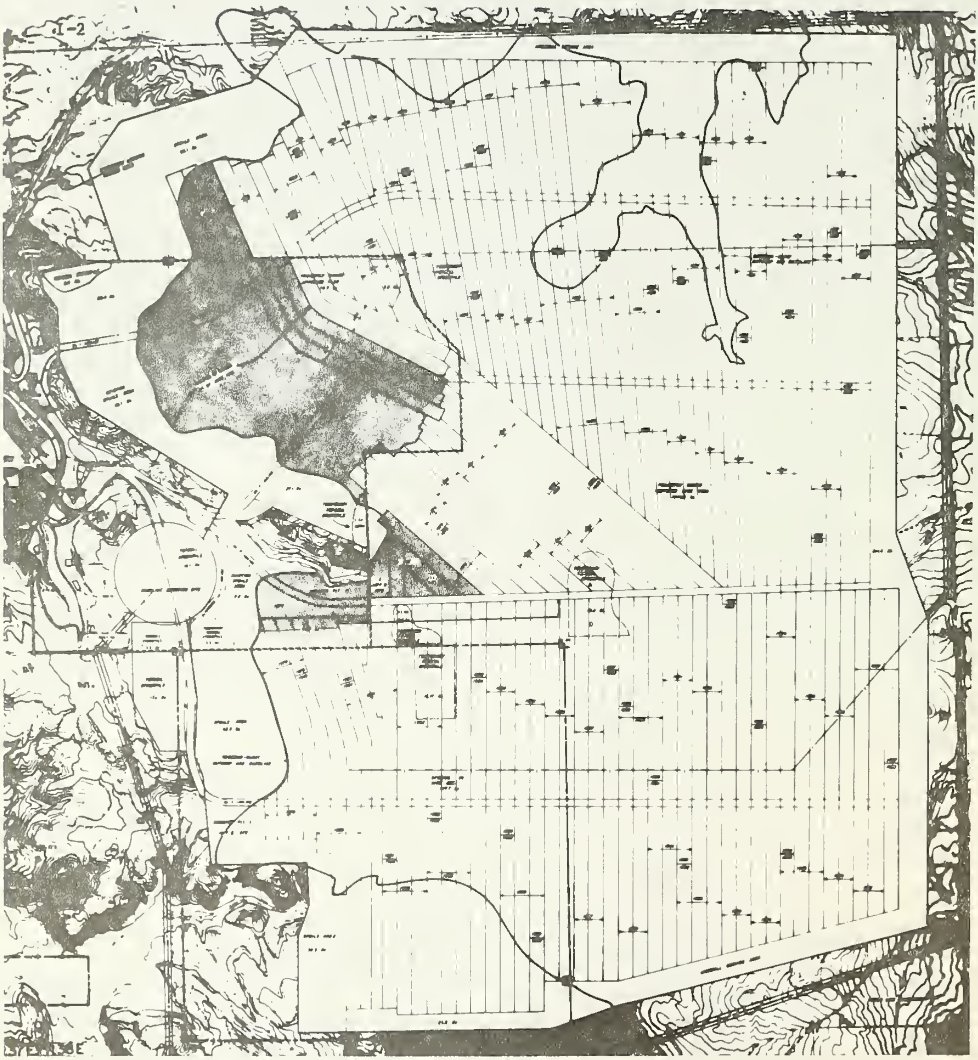

FIGURE I-1.--Sequence of mining at the Absaloka mine.

TABLE I-1.--Summary of Absaloka mine statistics

Permit application area (acres)------	361
Area previously permitted (acres)----	649
Coal lease area--Crow Tribe (acres)--	14,747
--State of Montana----	640
--Private------------	0
--Federal------------	0
Construction employees--------------	0
Operating employees, maximum (1984)--	310
Mine life (years)-------------------	20
Unit trains/week (both directions)---	38

TABLE I-2.--Ongoing and projected coal mines in Big Horn County and neighboring areas

Mine	Status	County	Maximum production (mty)
Absaloka------	Existing	Big Horn	4.6
Decker--------	Existing	Big Horn	14.0
Spring Creek--	Start 1980	Big Horn	7.0
Pearl---------	Start 1981	Big Horn	2.0
Rosebud-------	Existing	Rosebud	11.3
Big Sky-------	Existing	Rosebud	4.2
Big Horn------	Existing	Sheridan	2.0

No development of existing coal leases beyond that shown in table I-2 is assumed in the EIS, nor is the issuance of any additional major State or Crow coal leases. Large-scale development of other minerals such as oil and gas in Big Horn County and neighboring areas is not expected at this time and is not assumed in the analysis.

The analysis of environmental impacts in chapter III is based on Westmoreland's proposal, including the proposed mitigating measures outlined in chapter I. Additional mitigating measures required under existing laws and regulations are summarized in chapter IV; adverse environmental impacts that would be expected even with these additional mitigations are summarized in chapters V-VII. Chapter VIII examines alternatives to approval of the permit as proposed.

B. RELATED PERMITS

Westmoreland has applied for a discharge permit from the Department of Health and Environmental Sciences, a water appropriation from the

Department of Natural Resources and Conservation, and a road relocation permit from the Big Horn County Comissioners. The Office of Surface Mining has not determined whether additional OSM approvals would be needed in addition to mining plan approval issued by the U.S. Department of the Interior in 1977. Existing mine facilities would be used under existing permits.

Westmoreland holds coal leases on 30,876 acres on two tracts in the Crow ceded area, a 1.1 million acre strip of land immediately north of the Crow Indian Reservation. The Crow Tribe retains coal rights to the ceded area; the Bureau of Indian Affairs issued the leases to Westmoreland on behalf of the Tribe in 1972. Consolidation Coal Company assigned a State coal lease for Section 36, T. 1 N., R. 37 E. to Westmoreland in 1973.

Construction of the Absaloka mine on Westmoreland's 14,746 acre Tract III lease began in 1972. The Department of State Lands issued a strip mining permit for the first year of mining in February, 1974, and production began shortly thereafter. The permit application was analyzed in an EIS issued by the Department in 1973. Westmoreland's Tract II lease, west of the Absaloka mine, has not been developed.

An amended lease was signed by the Crow Tribe and Westmoreland in November 1974, following controversy over the terms of the original lease. Under the current lease, Westmoreland must mine coal at a rate of 10 mty by 1982 and 15 mty by about 1987; if they produce less, they must pay minimum royalties or return a portion of the lease to the Crow Tribe.

As a result of litigation brought in 1974 by local residents, the U.S. Department of the Interior, Bureau of Indian Affairs issued an EIS on its proposed reapproval of the coal leases in Tract II and III. The Secretary of the Interior reapproved the leases in early 1977. (See FES 76-64--U.S. Department of the Interior, 1976.)

In September 1975, Westmoreland submitted a 20 year mining plan to the U.S. Geological Survey. The application was analyzed in FES 77-17 (U.S. Department of the Interior, 1977) and was approved by the Secretary of the Interior in August 1977. The plan is designed to produce 10 mty from Tract III and the adjacent State-owned Section 36. The plan was reapproved by the Secretary in November 1977 as required under Federal regulations. The current application for a State permit is within the area of the Federal 20 year plan and is consistent with that plan.

In February 1978, the Department of State Lands approved Westmoreland's proposed expansion southward into State-owned section 36. This permit also allowed Westmoreland to increase its annual production rate from 5 mty to 10 mty. (See Montana Department of State Lands, 1977.)

C. COAL PRODUCTION

Table I-3 shows past and projected production from the Absaloka mine. The coal is shipped by unit trains to utilities in the northern

TABLE I-3.--Coal production from the Absaloka mine (tons)

Year	Past production	Projected future production	Approximate acreage mined/yr
1974---	1,457,672		
1975---	4,048,082		
1976---	4,083,894		
1977---	4,529,053		
1978---	4,554,201		
1979---------------		5,300,000	60
1980 through 1982---		7,250,000	80
1983---------------		7,750,000	85
1984 through 2000---		10,000,000	110

Midwest for electric power generation. Table I-4 shows the power stations now receiving coal from the mine. Shipments of coal during 1978 were curtailed by about 400,000 tons due to a shortage of railroad equipment. Projected future production is contingent on new coal sales.

TABLE I-4.--Power companies receiving coal from the Absaloka mine

Power company	Location	Amount (tons)	Mode of delivery
Northern State Power Co.--	Minnesota	2,900,000	Rail and barge
Central Illinois Light Co.	Illinois	1,000,000	Rail
Dairyland Power Cooperative------------	Wisconsin	500,000	Barge
Interstate Power Co.------	Iowa and Minnesota	300,000	Rail and barge
Wisconsin Power and Light Co.--------------	Wisconsin	300,000	Barge
Upper Peninsula Generating Co.----------	Michigan	270,000	Barge

D. MINING FACILITIES AND METHODS

1. Surface Facilities

Westmoreland proposes to use its present coal handling facilities, consisting of a truck dump, primary and secondary coal crushers, train loadout, and a coal storage barn. This existing coal processing system can handle 14 million tons/year (mty), sufficient to accommodate the proposed production level. Other structures at the mine include an office, shops, change houses, a boiler house, an equipment storage building, a repair shop, a water treatment plant, fuel tanks, a coal testing laboratory, and an ammonium nitrate (prill) storage silo.

Power is delivered to the mine by a Montana Power Company 69 KV line. Water for the plant and watering the haulroads comes from a deep well to the Madison aquifer at the plant site. A sewage lagoon treats all domestic wastewater from the plant. The haulroads connecting the pit with the plant are surfaced with scoria.

2. Mining Methods

Westmoreland is an "area" strip mine, in which a dragline makes a series of long, narrow pits, placing overburden from each succeeding cut into the previously empty pit. The following discussion of mining methods applies generally to both the existing and proposed future operations.

Prior to mining, marketable timber is removed and all other trees, slash, and debris is cleared and disposed of in the mine pit. Topsoil suitable for use in reclamation is salvaged in two lifts. The topsoil and subsoil is placed directly on the regraded spoils in separate layers, or is stockpiled separately for later use. The topsoil stockpiles are stabilized by seeding to wheat or barley, yellow sweetclover, and pubescent wheatgrass.

Overburden is drilled and blasted, then removed by a dragline. Spoil ridges are formed as the overburden is cast into the previous empty pit; these ridges are then regraded, surfaced with subsoil and topsoil, and reseeded.

Coal removal at the mine is complex because four separate seams are being mined. The Stray-1 seam is uppermost; it is thin (5 feet maximum thickness), erratic, and in places is difficult or impossible to remove. Where the Stray-1 is badly oxidized in areas of shallow cover, it is excavated as spoil.

The first principal seam is the Rosebud-McKay; it is 30-35 feet thick. The seam is normally exposed by dragline as described above; however, in areas of shallow cover it may be exposed by scrapers, especially near the crop and burn lines where draglines have difficulty operating. The Stray-2 coal underlies the Rosebud-McKay coal and is separated by a parting about 5 feet thick. This parting is fragmented by ripping with bulldozers and is removed by scrapers; the coal is then removed.

The Interburden between the Stray-2 and the bottom Robinson seam is 50 to 100 feet thick and is drilled, blasted, and removed in the same manner as the overburden. Because the small amount of room for spoils limits dragline operation, the Robinson coal, which averages 20 feet thick, cannot be recovered until at least the third dragline cut.

Coal is loaded into haul trucks by front-end loaders for transport to the coal handling facilities. The trucks use the haul roads shown in figure I-1. The trucks dump the coal into two bins, beneath which lie the primary crushers. The coal is crushed and conveyed to the secondary crushers, emerging with a top size of 2 inches, and then conveyed by belt to the train loadout building. Here the coal is loaded into a train or conveyed to the coal storage building, which has a capacity of 50,000 tons and holds coal for later loading into trains. The trains move continuously past the loading point; a typical 10,000 ton unit train can be loaded in 4 hours. The coal is weighed and samples are taken during loading.

Two outdoor coal storage areas are utilized for mine-run coal, primarily from the Stray-1 and Stray-2 seams, which are of lower quality than the coal from the major seams. This lower quality coal is blended with coal from the major seams to meet contractual obligations.

3. Mining Sequence

Figure I-1 shows the anticipated mining sequence at the Absaloka mine and areas previously mined. By 1984, the north pits will be aligned and will join to form one continuous pit. By 1992, the south pit in Section 31 will also be joined to the main pit.

E. MITIGATING MEASURES PROPOSED BY WESTMORELAND RESOURCES, INC.

Westmoreland must comply with legal requirements pertaining to surface coal mining in Montana, including the (Federal) Surface Mining Control and Reclamation Act of 1977, the Montana Strip and Underground Mine Reclamation Act, the Montana Clean Air Act and the pursuant State Implementation Plan, the Montana Pollutant Discharge Elimination System, and the regulations adopted pursuant to those statutes. State and Federal laws relating to antiquities, endangered and threatened species, and migratory birds also apply.

The applicant's proposal includes a number of mitigating measures which are designed to meet the requirements of existing laws and regulations. The discussion of environmental impacts in chapters III through VII of this EIS take into account the proposed measures outlined below. Additional mitigating measures not proposed by the applicant are discussed in chapter VIII.

1. Geology and Topography

Westmoreland will recontour spoils as closely behind mining as possible--no further than two spoil piles from the active pit. Recontouring will blend the mine area with surrounding topography and complement drainage patterns. Figure I-2 shows postmining land contours. Recontoured slopes will have a maximum slope of 5:1 (20 percent). Postmining drainage gradients will approximate premining gradients so that oversteepened sections are avoided.

2. Hydrology

An internal drainage system will channel runoff to a sediment control pond. The proposed extension of operations into the drainage of the East Fork of Sarpy Creek will require construction of eight additional sediment control dams. Figure I-3 shows the drainage system and existing and proposed ponds. Three of the proposed dams, Nos. 13, 14, and 15, will not have to be replaced as mining progresses. Ponds 8 through 12 will eventually be mined out after new ponds have been constructed downstream. All ponds will eventually be removed unless approved as permanent impoundments by the Department.

The drainage system and sediment ponds are designed to control flow from a 10-year 24-hour event. Drainage will be detained in sediment ponds until applicable water quality standards are met before being discharged downstream. Accumulated sediment will be removed from sediment ponds as necessary to provide adequate sediment storage capacity.

Prompt revegetation of reclaimed areas will serve to reduce sediment yield by stabilizing the soil surface. Revegetation of disturbed areas along roads, in the construction area, and on topsoil stockpiles will also control sediment.

Several erosion hazard areas have been rip-rapped to control erosion. These include the sediment pond outlet, the outlet of the culvert at Incline No. 1, and the downstream end of the "critical fragile area." Sediment traps (in most cases, dugout depressions) are utilized where drainage from disturbed areas may flow into undisturbed areas.

Westmoreland has developed a program to monitor quality and quantity of ground and surface water. This program is described in detail in an on-file report (Westmoreland, 1978).

3. Air Quality

The Absaloka mine already incorporates a number of measures to minimize adverse impacts on air quality. All conveyor belts are covered for dust control. Crushed coal is enclosed in a barn. Feed points to the crushers, the secondary crusher screen, and belt transfer points are hooded to prevent coal dust from escaping. The underside of the upper belt has a belt scraper at transfer points to remove coal dust and fine particles, which is then carried by a chute to the lower belt.

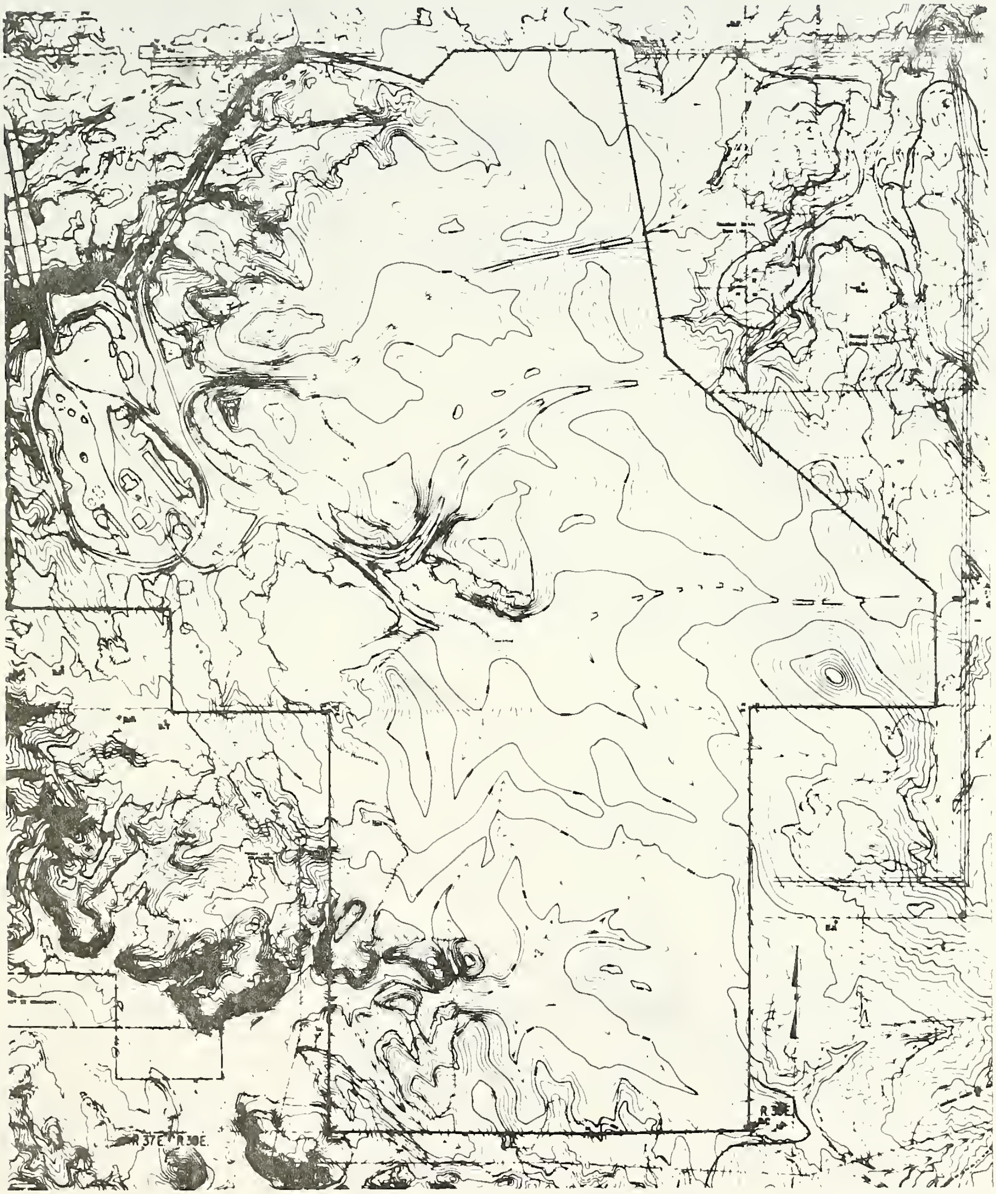

FIGURE I-2.--Proposed postmining land contours, 5-year permit area and existing mine. Contour interval is 10 feet.

FIGURE I-3.--Proposed drainage system.

The tripper gallery, plow tunnel, and crushers are washed down four to six times each week to remove dust accumulations. The sampling room is cleaned using a céntral vacuum system. A cyclone dust collector controls dust from a pressure vent from the surge bin.

The two coal-fired boilers at the mine are equipped with cyclone dust collectors. Ash from the fire boxes and the dust collector is buried in the waste disposal area.

During dry weather, roads at the mine are sprayed with water from two tankers to minimize dust emissions. The roads are seldom dusty in winter; when they are dusty, snow is placed on the road surface. Westmoreland is researching other methods of suppressing dust on mine roads, such as chemical binders.

Overburden drills have spray injectors that control dust. Explosives are now detonated from the bottom of blast holes, reducing dust emissions below previous levels. Dragline operators minimize the drop distance for the overburden, which reduces exposure of the overburden to wind.

Although precise reclamation scheduling is not always possible, Westmoreland expects to emphasize topsoil salvage and replacement during winter (in preparation for spring seeding) to reduce dust emissions. Prompt revegetation and restriction of the topsoil salvage area to ahead of the active pit minimizes blowing dust from exposed areas.

Mine employees are instructed to report any coal fires immediately. Burning coal is dug out and buried with the dragline, by hand, or with dozers.

Westmoreland's air quality monitoring system consists of 10 high-volume air samplers, 6 dustfall buckets, and a weather station in the vicinity of the mine. A description of this system is on file with the Department (Westmoreland Resources, Inc., 1978).

4. Soils

Regraded spoils are sampled and analyzed (prior to replacement of topsoil) for pH, conductivity, exchangeable sodium percentage, sodium adsorption ratio, particle size distribution, and, where indicated by premining studies, trace elements. In cases where recontoured spoils are sodic near the surface, adequate fill will be placed prior to topsoil replacement to assure an adequate rooting zone.

Recontoured spoil surfaces are roughened by discing on the contour. Topsoil is replaced in two separate lifts, with the upper layer, including the A horizon, placed as a surface layer over the subsoil. The minimum total depth of subsoil plus topsoil replaced is 2 feet.

Topsoil is salvaged and replaced selectively in two cases. Where ponderosa pine or skunkbush sumac is desired, scoria or sandstone soils

which previously supported these types are salvaged and replaced to a depth of 1 foot over 2 feet of sandstone subsoil. Where coulee bottom vegetation is desired, coulee bottom soils are salvaged and replaced in similar topographic locations.

5. Revegetation

Replaced topsoil is prepared using a subsoil plow on the contour to relieve compaction. Fertilizer is applied and a seedbed prepared. Table I-5 shows the seed mixture used. After seeding, 2 to 3 tons/acre of straw mulch is applied and then pressed into the ground. Seeding is done in the fall or early spring in order to make best use of seasonal moisture, and in the winter if weather and soil conditions are favorable.

If seeding is delayed in the spring, a stabilization crop of barley, oats, or wheat will be seeded. Stabilization seedings will not be mulched and will be seeded to grass in the fall. Where necessary, erosion channels will be repaired and hand seeded, mulched, and anchored.

Trees and shrubs will be transplanted in regraded areas and will be obtained from areas to be mined. Emphasis will be on re-establishing ponderosa pine although creek bottom species will be transplanted as well. Bare root and containerized seedlings of deciduous species and ponderosa pine will be planted in appropriate locations. Westmoreland is presently conducting experiments to evaluate containerized seedlings, bare root seedlings, and a variety of planting methods.

6. Land Use

The primary land use after mining and reclamation will be grazing. In addition, Westmoreland has identified areas which will be eventually be suitable for dryland agriculture.

In order to support livestock grazing, the company proposes to construct wells to the sub-Robinson aquifer, or if suitable water is available, in the replaced spoils. Use of wells will require that Westmoreland construct adequate pumping facilities and power lines. Sediment control dams may be retained as permanent impoundments for livestock, subject to approval by the Department.

TABLE I-5.--Westmoreland Resources, Inc. reclamation seed mix, Spring 1978

	Lbs/acre PLS*	Lbs/acre bulk
Cool season native grasses:		
Rosana western wheatgrass--------	3.9	4.5
Lodorm green needlegrass---------	2.4	3.0
Critana thickspike wheatgrass---	1.3	1.5
Whitmar beardless wheatgrass-----	1.3	1.5
Primar slender wheatgrass--------	0.6	0.7
Paloma Indian ricegrass----------	0.6	0.7
Sodar streambank wheatgrass------	0.6	0.7
Warm season native grasses:		
Pierre side-oats grama----------	1.2	3.0
Kaw big bluestem-----------------	0.6	1.5
Aldous little bluestem-----------	1.0	2.3
Blue grama-----------------------	0.7	3.0
Sand bluestem--------------------	0.9	2.3
Introduced Grasses:		
Luna pubescent wheatgrass--------	1.2	1.5
Kentucky bluegrass---------------	0.2	0.2
Hard fescue----------------------	0.2	0.2
Legumes:		
Eski sainfoin--------------------	1.8	2.3
Yellow sweetclover---------------	1.0	0.7
Shrubs:		
Four-wing saltbush---------------	Trace	Trace
Total--------------------------	19.5	26.3
Annuals:		
Wheat or barley------------------	10.0	10.0

*Pure live seed.

CHAPTER II

DESCRIPTION OF THE EXISTING ENVIRONMENT

This chapter describes the environment that would be affected by the proposed expansion of the Absaloka mine. Additional discussion of the existing environment is found in previous environmental impact statements (EIS's) on the Absaloka mine, including: FES 76-64 (U.S. Department of the Interior, 1976); FES 77-17 (U.S. Department of the Interior, 1977); Montana Department of State Lands, 1977; and for region-wide conditions, DES 79-41 (U.S. Department of the Interior and Montana Department of State Lands, 1979). The information in those EIS's has been updated and expanded in this chapter to provide a context for the discussion of environmental impacts in chapter III.

A. GEOLOGY

The geology and topography of the Tract III area has been described in detail in previous environmental statements (FES 76-64, FES 77-17, and Montana Department of State Lands, 1977). This summary, adapted from FES 77-17, describes the 20-year mining plan area.

1. Topography and Geomorphology

The proposed mining area in Tract III straddles the drainage divide between East Fork and Middle Fork Sarpy Creek. The divide is a gently rolling surface approximately 1/4 mile wide drained by ephemeral tributaries to the above-named streams. Topographic relief is about 200 feet within the 5 year mine plan area and about 300 feet within the 20 year mine plan area.

Tributaries draining northward to East Fork occur in densely vegetated coulees which vary in length up to about 2 miles. Evidence of accelerated erosion is generally absent. Dominant erosional processes active on the present landscape likely include rainsplash, wind, and sheet and rill wash. Significant channel erosion has not been observed due largely to relatively coarse soils, low surface gradients, and good vegetative cover, all of which promote low runoff and high infiltration rates.

2. Stratigraphy

The entire area proposed for mining is underlain by the Tongue River Member of the Fort Union Formation, which contains all of the coal seams of economic importance in this area. The Tongue River Member is composed mainly of variegated siltstone, mudstone, shale or claystone, and inter-bedded sandstone layers. The two lowermost important coal seams of the Tongue River Member--the Robinson and the Rosebud-McKay--are preserved in this area. The lowest of the two seams, the Robinson, is about 20 feet thick, and the higher Rosebud-McKay is about 30 feet thick. Two stray seams, each 3 to 5 feet thick, are present locally above and below the Rosebud-McKay seam. All younger and stratigraphically higher coal seams have been removed by erosion.

Shale and siltstone constitute most of the overburden and about half the interburden southeast of the structural low. Clay immediately underlies both coal seams. Sandstone forms most of the lower part of the member below the Robinson seam. Northwest of the structural low, sandstone layers are most uniformly distributed throughout the member, and underlie most of the land surface. There, too, the coal seams are immediately underlain by impermeable shale or claystone.

3. Coal Resources

The coal resource holdings of Westmoreland Resources, Inc. have been described in detail in FES 76-64 and FES 77-17. The following summary is adapted from FES 77-17.

Of the 850 million tons of mineable coal underlying the entire Tract III, about 600 million tons is recoverable under current economic conditions. The 20 year mine plan approved by the Department of the Interior in 1977 envisions the extraction of 190.6 million tons by 1997, in addition to the 5.5 million tons mined through 1975 from the existing mine. The coal is classed as subbituminous "B", has a heating value of 8,450 Btu/lb, and contains 0.73 percent sulfur. Analyses of coal from Tract III are found in FES 77-17.

4. Overburden and Interburden

Overburden material above the Rosebud-McKay coal seam differs in many respects from the interburden between the Rosebud-McKay and the lower Robinson coal seam. Table II-1 illustrates the major important differences which would affect reclamation.

TABLE II-1.--Comparison between important properties of overburden and interburden

[Data are in percent]

	Overburden	Interburden
SAR>12*----------	1	91
Clay>40%*--------	6	19
Ni>1.0 ppm*------	31	92
Mo>0.3 ppm*------	58	97
EC>6*------------	1	---
Zinc>40 ppm*-----	---	---
pH>9.0-----------	---	---

*State guideline maximums.

The data shown in table II-1 indicate that the overburden material is a resource better suited to near surface placement for reclamation than is the subRosebúd-McKay interburden. In addition to the chemical and physical parameters, there are indications from the Absaloka and other mines extracting coal from the Rosebud and McKay seams that the dominant clay mineral is kaolinite, a relatively stable material subject to minimal shrink/swell problems. Cation Exchange Capacity (CEC) values indicate that other clay minerals are also present. The interburden material has a significant component of montmorillonite. This mineral has a high shrink/swell potential, and also reacts more adversely to elevated SAR values.

B. HYDROLOGY

1. Surface Water

Surface water resources of the Absaloka mine area have been described in FES 76-64 (U.S. Department of the Interior, 1976); FES 77-17 (U.S. Department of the Interior, 1977); and Montana Department of State Lands, 1977.

Westmoreland Resources Tract III is drained by tributaries of Sarpy Creek, a tributary of the Yellowstone River. Tract III drains toward both East Fork and Middle Fork Sarpy Creek. Current mining operations are disturbing the upper watershed of only the latter; however, because Westmoreland Resources, Inc. has constructed minor diversions and sedimentation impoundments to comply with State and Federal regulations, mining operations since 1974 in the headwaters of Middle Fork Sarpy Creek have had no discernible impact on the surface water resource of the Middle Fork basin. The proposed 5- and 20-year mine plan areas both cross into the headwaters of coulees tributary to East Fork Sarpy Creek. There are no perennial streams located within Tract III; surface drainage is accomplished by overland flow and by interrupted ephemeral reaches within tributary coulees.

The drainage area of East Fork Sarpy Creek above its confluence with Sarpy Creek is about 81 square miles. That portion of the 5 year mine plan area contained within the East Fork watershed is approximately 360 acres, or .7 percent of the East Fork basin. The 20 year mine plan area covers approximately 2 mi^2, (2.5 percent) of the East Fork Sarpy Creek basin. The 20 year plan is entirely within the Sarpy Creek drainage basin, and covers approximately 7.4 mi^2 (1.6 percent) of that basin. Records of the U.S. Geological Survey (Water Year Reports, 1975-78) indicate that annual runoff from the Sarpy Creek drainage basin averages about 11 acre feet/ mi^2. However, based upon the established principle that runoff per unit area in semiarid regions increases with decreasing drainage area, it is believed that mean annual runoff for small watersheds tributary to the Sarpy Creek more closely approximates 19 acre feet/mi^2 (Hadley and Schumm, 1961) to 27 acre feet/mi^2 (FES 77-17).

The most prominent and important surface water features within the 5 and 20 year mine plan areas are the numerous springs located within several coulees tributary to East Fork Sarpy Creek (figure II-1 and table II-2). Only one spring, No. 276, is within the 5 year mine plan area; at least 10 additional springs are located within the 20 year mine plan area. These springs are the surface expression of a complex ground water system and issue primarily from the Rosebud-McKay overburden and clinker. (See Ground Water.) They are important because, along with the associated high ground water table, they support a dense growth of vegetation within the coulee bottoms, which in turn, provide significant food and cover for area life systems. (See Land Use, Vegetation and Wildlife.) The springs themselves are likewise heavily used by livestock and wildlife.

Little information is available concerning the discharge of the springs, but they probably increase in flow in the spring and decrease during summer as adjacent vegetation increases evapotranspirative use of available water. A common water table drop during fall and winter months may also cause a general decrease in spring flow, although this may be balanced by the cessation of evapotranspiration.

The springs occur as isolated discharges or seeps along coulee bottoms. Many have been improved by ranchers so that water may be more readily available to livestock. The springs flow for varying short distances down-coulee before the water infiltrates into the coulee bottoms. There is no evidence of continuous, active surface water channels throughout the length of the two major coulees draining northeastward from the 5 year mine plan area. This indicates that channeled surface water runoff contributes relatively little to the East Fork Sarpy Creek drainage in this vicinity.

A review of 176 townships covering the Fort Union coal region of southeastern Montana indicates that the Tract III lease area of Westmoreland Resources probably does not contain a greater density of springs than other townships within the region, nor is the water quality of these springs significantly better than that of other springs within the same region (Westmoreland Resources, 1978). Locales of high spring density within the region tend to be located adjacent to uplands, such as the Wolf and Little Wolf Mountains and in the Ashland District of Custer National Forest. This suggests that the scale of comparison is the single most important factor in any statement concerning the density of springs in Tract III. The density of springs per unit area in Tract III is possibly significantly greater than in eastern Montana as a whole; however, when compared to areas of similar topographic relief, geology, and climate the density of springs within Tract III is probably not unusual.

The intermittent surface flow provided by the springs, as well as the associated ground water flow within the coulees, ultimately contributes to the ground water component of flow within the East Fork Sarpy Creek valley. Field observations and data provided by Westmoreland Resources (figure II-2) indicate that both East Fork and Middle Fork Sarpy Creek

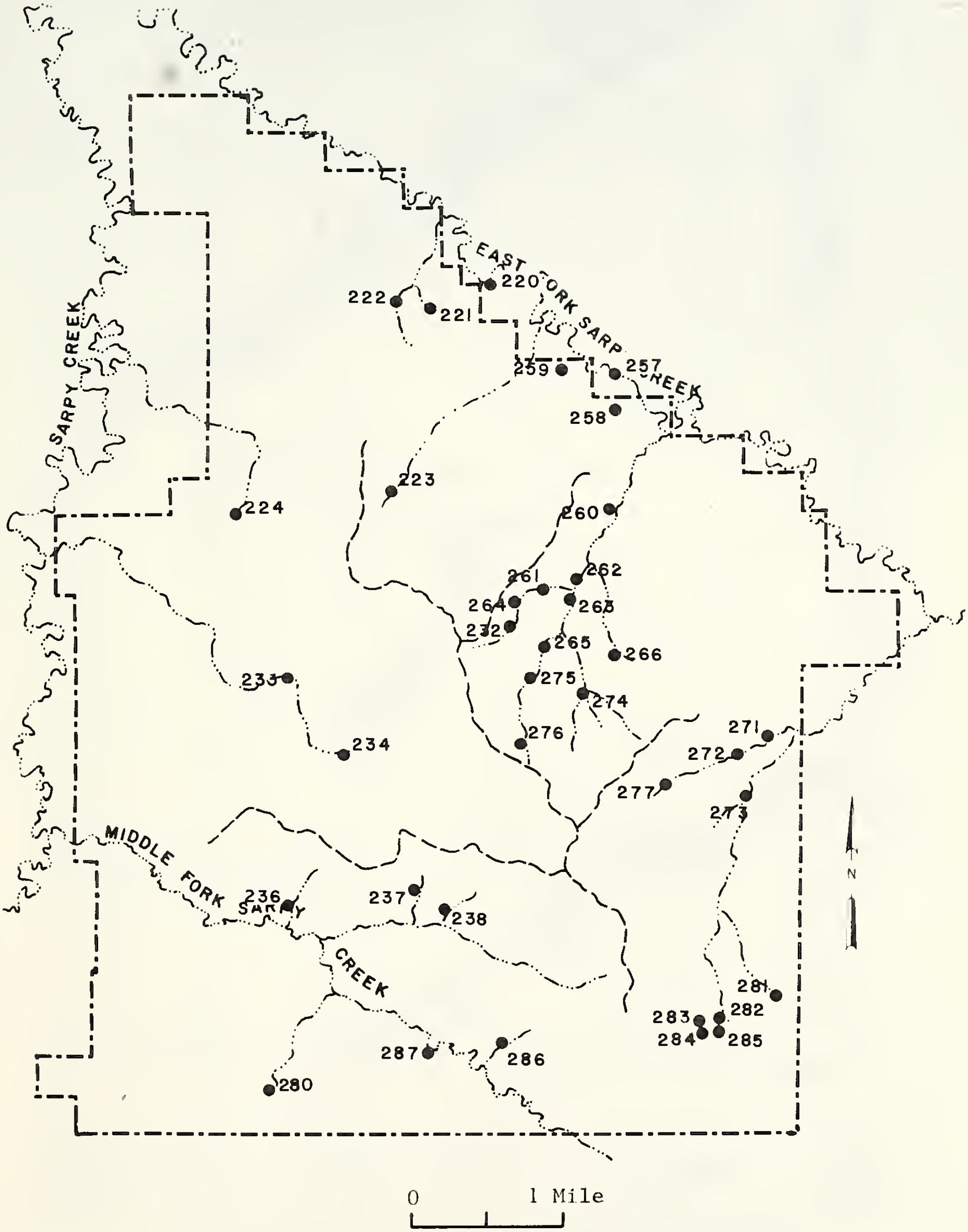

FIGURE II-1.--Map of springs within Tract III. Dashed lines within Tract III show selected drainage divides.

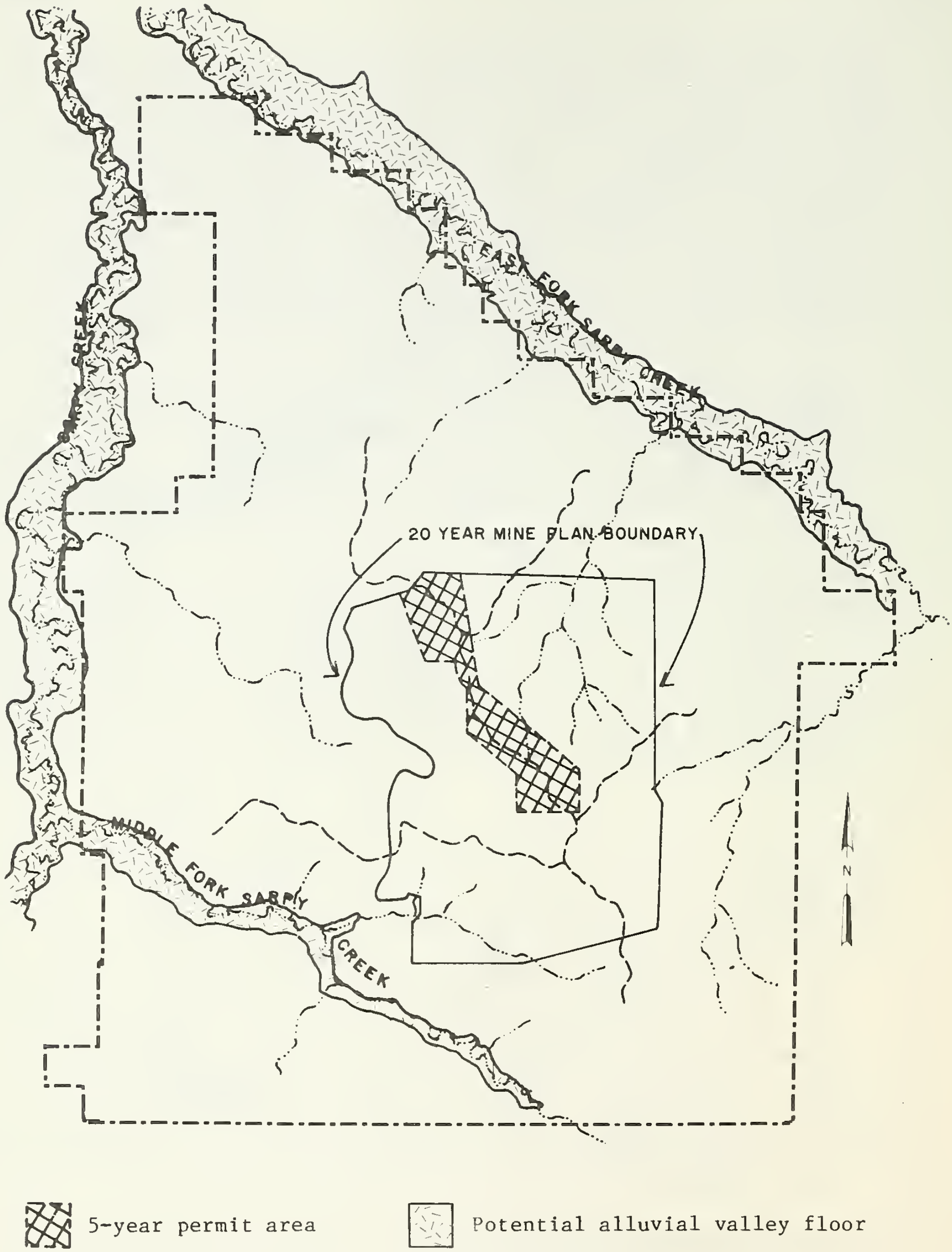

FIGURE II-2.--Potential alluvial valley floors within and adjacent to Tract III.

TABLE II-2.--Spring data for selected springs in Tract III

[Source: U.S. Department of the Interior, 1977]

Spring number[a]	Water source[b]	Elevation[c] (feet)	Estimated flow (gpm)	Specific conductance (umhos/cm)[d]	Use[e]
220-----	Tfu	3,280			S
221-----	rmcl	3,430	1		S
222-----	rc	3,365	1		S
223-----	rmcl	3,430		1450L	
224-----	rmcl	3,420			
232-----	Ttrl	3,470	.5		
233-----	rc	3,425		1400L	
234-----	rmcl	3,467		1010L	
236-----	rc	3,435			
237-----	rmc	3,497		743L	S
238-----	Q	3,477			S
257-----	rc	3,300			S
258-----	rc	3,300			
259-----	rc	3,300			
260-----	Q	3,360	1		S
261-----	rmcl	3,440	1	1580L	S
262-----	Q	3,392			S
263-----	Q	3,405		1460L	
264-----	Ttrl	3,455		1750	
265-----	rmcl	3,445		1999	S
266-----	Ttrl	3,468		734L	
271-----	Ttrl	3,460			
272-----	Ttrl	3,470		1340L	S
273-----	Ttrl	3,465		2060L	S
274-----	Ttrl	3,460			S
275-----	rmcl	3,465		1880L	S
276-----	Ttrl	3,560			S
277-----	Ttrl	3,520		742L	S
278-----	Ttrl	3,510			
279-----	Ttrl	3,519	.1		S
280-----	rmcl	3,560		753L	
281-----	Ttrl	3,650		1620L	
282-----	Ttrl	3,575		2400L	S
283-----	Ttrl	3,592		1040L	

TABLE II-2.--Spring data for selected springs in Tract III--Continued

Spring number[a]	Water source[b]	Elevation[c] (feet)	Estimated flow (gpm)	Specific conductance (umhos/cm)[d]	Use[e]
284-----	Ttrl	3,625		1620L	
285-----	Ttrl	3,615		1530L	
286-----	rmc	3,475			
287-----	rmc	3,480			

[a]Spring number indexed to locations and shown on figure II-1. Data are from VanVoast and Hedges, 1974.

[b]Source: Q - Quarternary alluvium or slope wash; Ttrl - Tongue River member above Rosebud-McKay Coal; rmcl - Rosebud-McKay clinker; rmc - Rosebud McKay Coal; rcl - Robinson clinker; rc - Robinson Coal; Tfu - undifferentiated Fort Union formation.

[c]Estimated from U.S. Geological Survey 7.5 minute topographic maps.

[d]Values shown are field measurements except as noted L, which are laboratory measurements.

[e]S - stock, H - domestic, U - unused.

very probably meet preliminary criteria for delineating alluvial valley floors under Montana and Federal strip mine laws. Final determination regarding alluvial valley floors designation remains to be made by the Department. No areas tentatively identified as potential alluvial valley floors are included within the 5 year or 20 year mine plan areas. Should adjacent portions of East Fork and Middle Fork Sarpy Creek be designated as alluvial valley floors by the Department, special attention would have to be given to any potential mining impacts on the hydrologic function of those streams.

2. Ground Water

Within the proposed mine area, there are several ground water bearing zones, which are, in descending order: alluvium and colluvium within the coulees, Rosebud-McKay overburden, Rosebud-McKay coal, Robinson coal, and sub-Robinson aquifers. Other aquifers occur at greater depths, including the Madison limestone, from which Westmoreland Resources obtains most of its industrial purpose water. All of these water bearing zones and aquifers have been discussed in detail in FES 76-64 (U.S. Department of the Interior, 1976); FES 77-17 (U.S. Department of the Interior, 1977); and Montana Department of State Lands, 1977. Ground water bearing zones and aquifers stratigraphically below the Robinson coal have to date been unaffected by mining and are not discussed further.

The most important ground water bearing units in the immediate mine vicinity are the alluvium and colluvium underlying the coulees draining the mine area (figure II-1) and the Rosebud-McKay overburden. These units support numerous springs within the coulees draining the mine area and transmit both ground and surface water toward East Fork Sarpy Creek. The coulees receive recharge by at least three primary means. Point source recharge occurs from springs issuing from both the Rosebud-McKay overburden and from adjacent clinker. Less direct but possibly equally as important recharge to the coulees occurs by subsurface flow from both the overburden and the clinker. The least important means of recharge to the coulees appears to be from direct precipitation. The total ground and surface water flow within the coulees results in a water table very close to or at the ground surface and supports a wide variety of dense vegetation on the coulee bottoms.

Another important water bearing unit within the mine area is the Rosebud-McKay overburden. Data submitted by Westmoreland Resources, Inc. indicates that all recharge to the overburden within the vicinity of proposed mining is derived from local precipitation. Ground water movement within the overburden is generally away from the ground water divide which closely approximates the surface water divide between East Fork and Middle Forks of Sarpy Creek. (See figure II-3.) Discharge from the overburden both east and west of the ground water divide is laterally to adjacent Rosebud-McKay clinker and to springs occurring within coulees draining the divide and to a much lesser extent, downwind to the underlying Rosebud-McKay coal. The overburden is the ground water source for many of the springs found in the heads of coulees tributary to East Fork Sarpy Creek and supplies much of the ground water moving down the coulees. (See figure II-1.)

Another ground water bearing unit of importance is the Rosebud-McKay clinker. Although not within the boundaries of the 5 year mine plan area, it is within the boundary of the 20 year plan area east of the divide and contributes to much of the water flowing within the coulees. It probably receives recharge at high rates from direct precipitation, and in lesser amounts from adjacent overburden and unburned Rosebud-McKay coal. The clinker discharges through springs located within the coulees and by direct subsurface flow to the coulees. At the upper end of the coulees the base of the the clinker underlies the surface of the alluvium and colluvium within the coulees; down-coulee the clinker base is exposed along the sides of the coulees and is demarcated by more vigorous vegetation. This occurs because the gradient of the coulee bottoms is steeper than that of the base of the clinker. Because the clinker is highly transmissive, it allows ground water flow at high rates, but does not readily store ground water in large amounts.

The water-bearing coal seams within the mine area--the Rosebud-McKay and Robinson seams--allow comparatively little ground water movement through the mine area, especially when compared to the overburden or the clinker. Collectively the Rosebud-McKay and Robinson seams are of little importance to total ground water movement within the area.

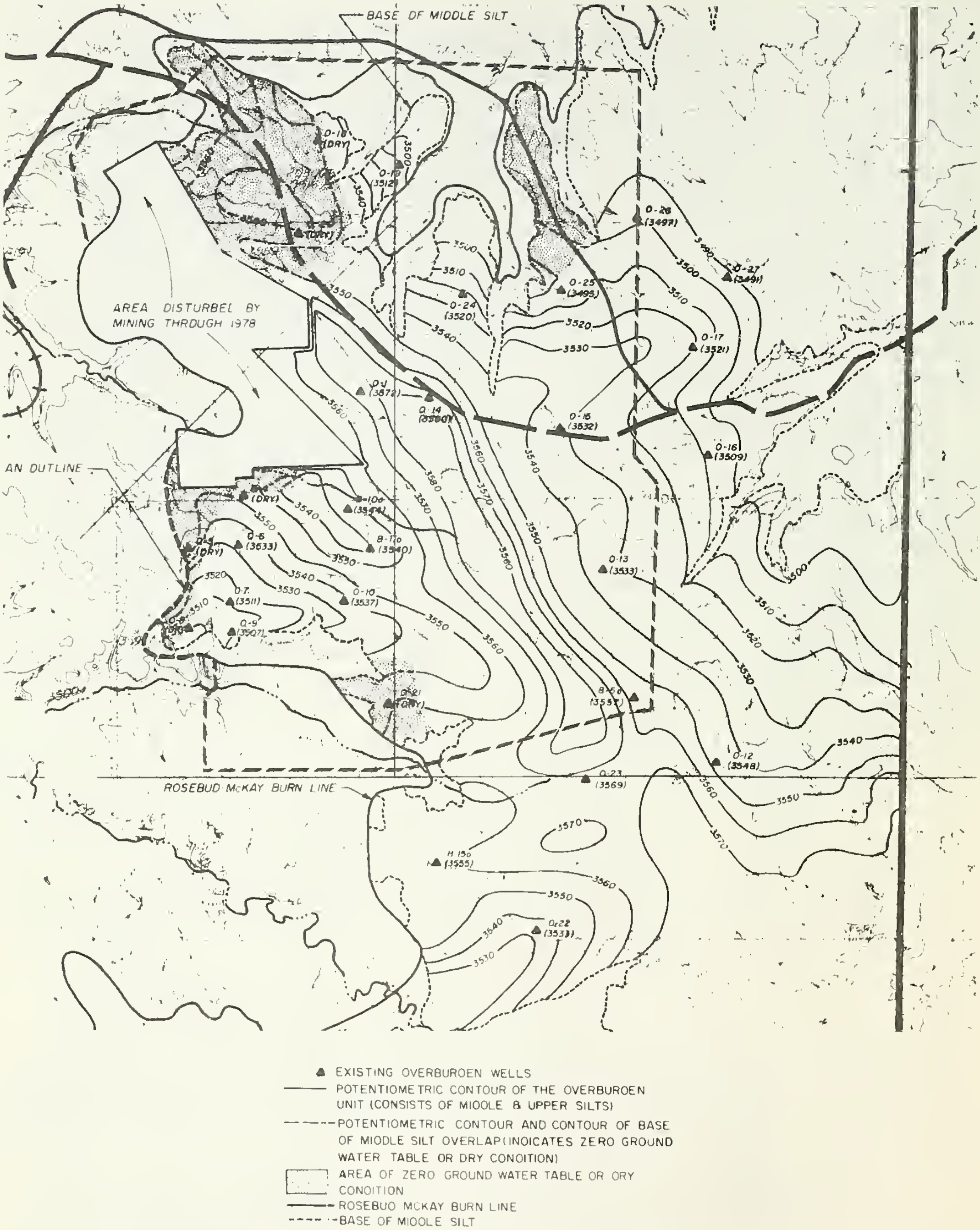

FIGURE II-3.--Map of preliminary potentiometric surface of overburden unit in Tract III.

Ground water within the proposed mining area is potable and suitable for most purposes. Numerous ground water quality data for the area have been reported in FES 76-64 (U.S. Department of the Interior, 1976); FES 77-17 (U.S. Department of the Interior, 1977); and Montana Department of State Lands, 1977. The location of the mine area on a drainage divide and the sufficiency of good quality surface water supplies have resulted in relatively few wells in the immediate mine area. (See figure II-4.) Data for wells shown in figure II-4 are provided in table II-3.

C. CLIMATE

The Sarpy Creek area has a continental climate with extremes of temperature and relatively low humidity. Cold waves with subzero temperatures, high winds, and blowing snow are common during the winter. Temperatures may drop to below -50° F. Summer temperatures typically exceed 100° F. at some locations each year. Average annual precipitation is about 15 inches, nearly half of which falls from April through June.

Meteorological equipment was installed at the Absaloka mine in 1978. From June 1, 1978, through December 31, 1978 temperatures at the mine ranged from 101° F to -38° F. In 1978, the area received about 22 inches of precipitation--well above average.

In 1978, winter winds were generally from the south-southeast and averaged about 5 miles/hour. The strongest winter winds were from the northwest with 20 miles/hour the highest hourly average. Spring winds were generally from the northwest and southeast, and averaged about 8 miles/hour; the highest hourly average of 28 miles/hour came from the northwest. Summer winds averaged about 6 miles/hour and blew as frequently from all directions. Fall winds were generally from the west and south, averaging about 6 miles/hour; the strongest winds were from the west with a maximum hourly average of 24 miles/hour. Calm periods were rare, occurring 0.3 percent of the time in winter and spring, 0.4 percent in the summer, and 1.7 percent in the fall.

Evaporation at the mine was measured with a Class A evaporation station at the mine office from May 22, 1978 to October 30, 1978. During that period, evaporation was measured on 143 days for a total of 34.78 inches or about 0.24 inches/day.

D. AIR QUALITY

The rural areas of Big Horn County have generally excellent air quality. Fugitive dust is the main air pollution problem, coming from unpaved roads, fallow fields, overgrazed land, exposed soft rock outcrops, towns, and strip mines (DES 79-41).

The annual geometric mean for total suspended particulates (TSP) in Hardin was 19.5 ug/m^3 in 1978--well within the Federal secondary standard

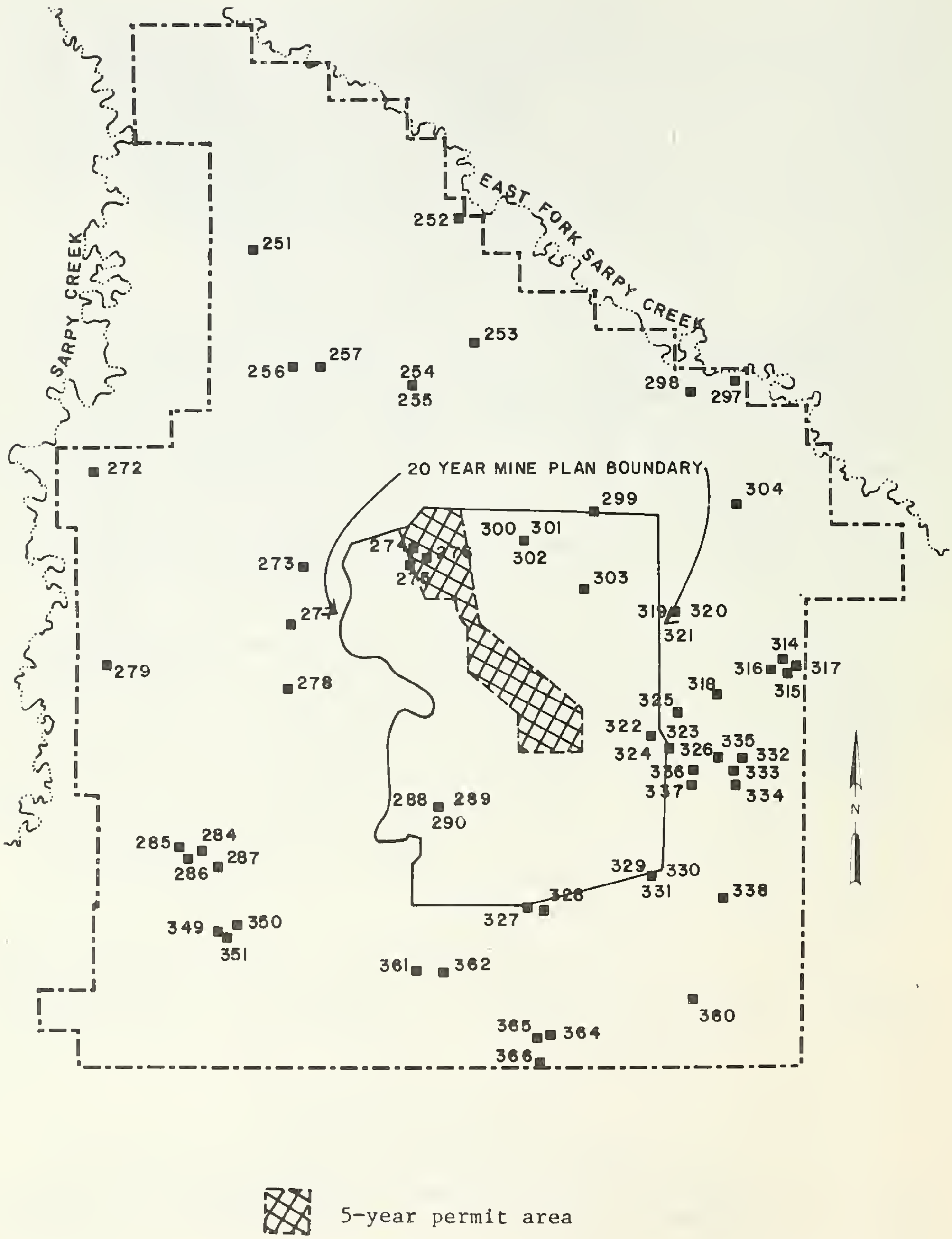

FIGURE II-4.--Map of wells within Tract III.

TABLE II-3.--Well data for selected wells in Tract III

[Source: U.S. Department of the Interior, 1977]

Well number[a]	Well depth (feet)	Depth to water[b] (feet)	Elevation[c]	Date examined	Conductivity[d] (umhos/cm)	Water use[e]	Water source[f]
251----	164		3,351			S	Tfu
252----			3,292			H	Tfu
253----		36.5	3,355			S	
254----	72	24.4	3,408	11-73		M	rc
255----	125	87.4	3,408	11-73		M	Ttr3
256----	130	60	3,395	7-72	2000L	S	Tfu
257----	50		3,451			S	rmcl
272----			3,300	7-72	2310	S	Tfu
273----	80	41	3,450	7-72	1690L	S	rc
274----	15		3,540			S	rmc
275----	8	6	3,549	7-72	910	U	Ttrl
276----	11	6.8	3,550	10-73		U	Ttrl
277----	123	39.5	3,419	7-72	941L	U	Tfu
278----	7977	+175	3,545	10-73	1926L	U	MC
279----	30	8	3,360	8-72	2430L	U	Tfu
284----		21.2	3,380	9-73	5130L		Tfu
285----	80	28.3	3,220	9-73		U	Tfu
286----	60	19.2	3,210	9-73		U	Tfu
287----			3,390	8-72	1390	S	Q
288----	110	46.8	3,545	11-73		M	rmc
289----	196	108.7	3,545	11-73		M	rc
290----	288	160.4	3,545	11-73		M	Ttr3
297----	113	63.5	3,396	8-73	712L	S	Tfu
298----	190	78.5	3,408	8-73		S	Tfu
299----	160	24.5	3,463			S	rmc
300----	45	10.1	3,450	11-73		M	rmc
301----	125	50.6	3,450	11-73		M	rc
302----	232	124.7	3,450	11-73		M	Ttr3
303----	115	36.7	3,450	7-72	1440	U	rc
304----			3,475			S	
314----			3,473	7-72	925L	H	rmc
315----	100	28	3,482	7-72	816L	H	rmc
316----	20	0	3,440	7-72	1260		Ttrl
317----	20		3,440	7-72	1780	S	Ttrl
318----	45		3,510	8-72	834L		rmc
319----	142	114.5	3,565	11-73		M	rmc
320----	215	162.3	3,565	11-73		M	rc

TABLE II-3.--Well data for selected wells in Tract III--Continued

Well number[a]	Well depth (feet)	Depth to water[b] (feet)	Elevation[c]	Date examined	Conductivity[d] (umhos/cm)	Water use[e]	Water source[f]
321----	290	182.9	3,565	11-73		M	Ttr3
322----	61	32.6	3,550	7-72		M	Ttrl
323----	111	46.3	3,550	7-72	905	M	rmc
324----	212	110.8	3,550	11-73		M	rc
325----			3,508	7-72	1820		rmc
326----	50	23.2	3,528	7-72	921	U	rmc
327----	165	71.0	3,534	1-73	1680L	H	rc
328----			3,529	8-72	1575	H	
329----	63	29.6	3,585	11-73		M	Ttrl
330----	135	56	3,585	11-73		M	rmc
331----	267	110.6	3,585	11-73		M	rc
332----			3,500			S	
333----	15		3,490			S	Q
334----	15		3,490			S	Q
335----	15	6	3,490	8-72	719	S	Q
336----			3,530	8-72	1032	S	
337----	225		3,530	8-72	2440	S	Tfu
338----	164	75.4	3,620	8-72	958L	S	Ttrl
349----	174	55.6	3,494	9-73	2380L	U	Tfu
350----	180		3,501	9-73	3287L	S	Tfu
351----	300	100	3,509	9-73		H	Tfu
360----	180	80	3,652	6-73	578L	S	Ttrl
361----	83	57	3,466			U	Tfu
362----	44	14.3	3,480			U	rc
365----	80		3,505	7-72	1230L	H	rmc
366----	84	5.9	3,508	7-72	1780L	S	rmc

[a]Well number indexed to locations and shown on figure II-4. Data are generally from VanVoast and Hedges, 1974.

[b]Whole numbers only--reported; whole numbers and tenths--measured.

[c]Estimated from U.S. Geological Survey 7.5 minute topographic maps. Reference in feet relative to mean sea level.

[d]Specific conductance measured in field unless otherwise noted (L indicates laboratory measurement) at 25° C.

[e]C - commercial or industrial; H - domestic; S - stock; U - unused; M - observation monitoring well.

[f]Source: Q - Quaternary alluvium or slope wash; Ttrl - Tongue River member above Rosebud-McKay Coal; Ttr2 - Tongue River member between Rosebud-McKay Coal and Robinson Coal; Ttr3 - Tongue River member to about 100' below Robinson Coal; rmcl - Rosebud-McKay clinker; rmc - Rosebud McKay; rcl - Robinson clinker; rc - Robinson Coal; Tfu undifferentiated Fort Union formation; HC - Hell Creek formation; MC - Mission canyon member of the Madison formation.

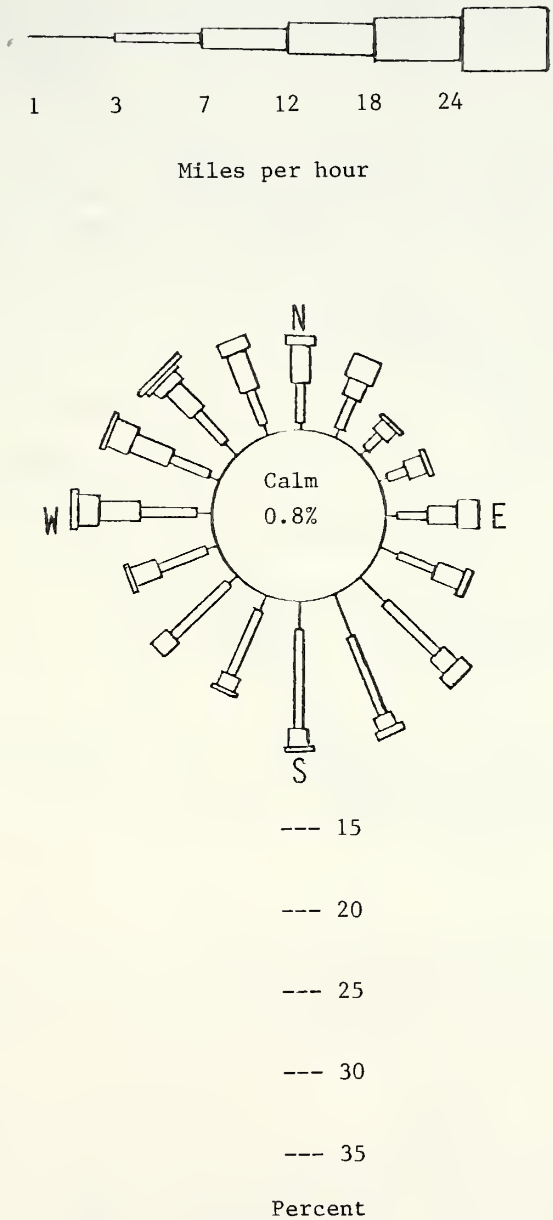

FIGURE II-5.--Annual wind rose for the Absaloka mine.

of 60 ug/m^3. (See table II-4.) The highest monthly average TSP was 56 ug/m^3 in August. TSP readings were elevated in spring, summer, and fall, and were lowest in winter (Montana Department of Health and Environmental Sciences, 1978).

TABLE II-4.--Ambient air quality standards

Montana ambient standard for total suspended particulate (TSP):

75 ug/m^3, annual geometric mean
200 ug/m^3, not to be exceeded more than 1 percent of days a year

Montana ambient standard for settled particulate (dustfall):

Residential areas: 15 $tons/mi^2/month$, 3 month average
Heavy industrial areas: 30 $tons/mi^2/month$, 3 month average

National Ambient Air Quality Standards (NAAQS) for TSP:

Primary standard (for protection of human health):
75 ug/m^3, annual geometric mean
260 ug/m^3, maximum 24 hour concentration, not to be exceeded more than once a year

Secondary standard (for protection of human welfare):
60 ug/m^3, annual geometric mean
150 ug/m^3, maximum 24 hour concentration, not to be exceeded more than once a year

Fugitive dust near the Absaloka mine has increased significantly since the mine opened in 1974 (Montana Department of State Lands, 1977). TSP was measured at nine sites within and adjacent to the mine (figure II-6). Annual geometric mean TSP at various monitors were as follows:

Site H-1A: 14 ug/m^3	Site H-3: 12 ug/m^3
Site H-2: 50 ug/m^3	Site H-5: 15 ug/m^3

Not enough values were available from the other sites to calculate a meaningful annual geometric mean. There were no sites that exceeded the National Ambient Air Quality Standard (NAAQS) or the Montana ambient standard for annual geometric mean (table II-4).

Sites H-1A and H-6 each had one excursion greater than 150 ug/m^3, which did not violate the Federal secondary standard. Site 2, which is near the mine loadout and shop, had 11 greater than 150 ug/m^3, with a

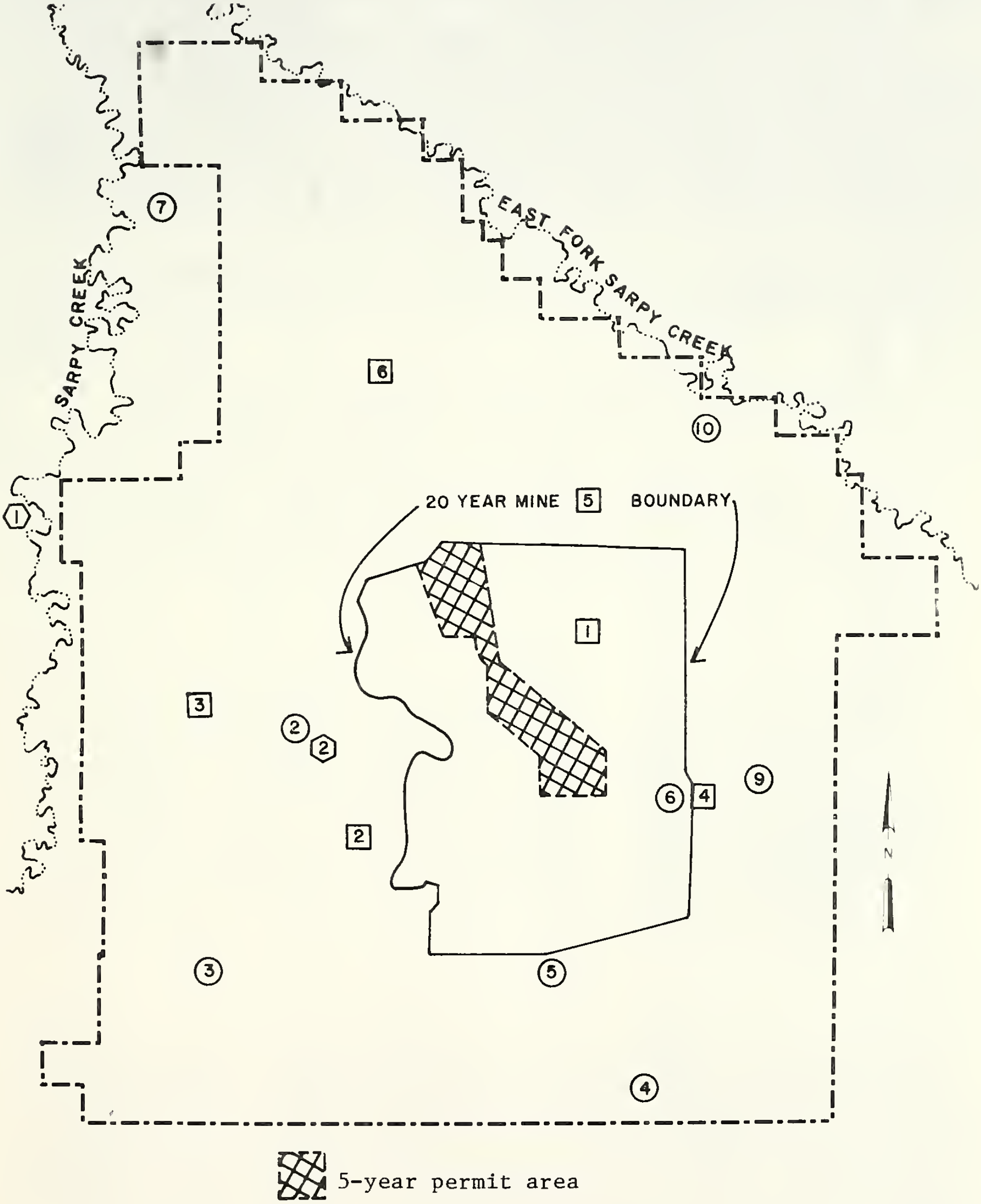

FIGURE II-6.--Location of air quality monitoring stations within and adjacent to Tract III. Circles show high volume air samplers; squares show dustfall collectors; hexagons show meteorological stations.

maximum reading of 414 ug/m^3 on April 26, 1978. Because Site 2 is within the mine boundary, its data are not valid for enforcement purposes.

Six monitors recorded dustfall levels (settled particulate) on and near the mine. (See figure II-6.) Table II-5 shows the three month running averages for dustfall. Dustfall readings were generally above those allowed for residential areas, but with two exceptions were less than those allowed for heavy industrial areas. (See table II-4.) Dustfall in locations away from the mine, designed to record background concentrations, were among those showing readings in excess of the standard for residential areas.

Gaseous emissions at the mine are not considered serious enough to require monitoring.

TABLE II-5.--Dustfall in the Absaloka mine area, 1978

[Data are in $tons/mi^2/month$. Source: Westmoreland Resources, Inc., 1979.]

3 month period ending	Monitor site				
	D-1	D-2	D-3	D-5	D-6
March--------	14.6	9.7	9.4	14.3	9.7
April--------	20.0	10.6	10.2	15.6	13.2
May----------	--	12.2	--	--	--
June---------	15.4	14.2	11.3	34.3	14.9
July---------	9.8	16.7	16.7	35.3	17.2
August-------	13.7	18.1	17.6	22.4	18.0
September----	16.7	23.3	18.9	14.8	16.9
October------	19.7	23.5	22.6	17.1	16.4
November-----	14.0	22.6	--	14.3	15.0
December-----	--	19.0	--	15.5	15.7

E. SOILS

Existing soils are discussed in considerable detail in chapter II of FES 77-17 (U.S. Department of the Interior, 1977). Descriptions of soil profiles and mapping units are found in appendix D of FES 77-17. Additional information is available in appendix B of Montana Department of State Lands, (1977). The discussion of existing soils in that EIS does not directly apply to the proposed action considered here, but the appended data pertains to Tract III in its entirety. The data were provided by the company in support of several permit applications.

Table II-6 summarizes important non-chemical properties of the soils resource within the area of the proposed 5-year mine plan. The

TABLE II-6.--Affected soils and selected resource parameters within the proposed 5 year mine plan area

Soil series	Mapping units	Soil Conservation Service taxonomic classification	Capability grouping	Topsoil salvage (acre feet)	Potential increase[1] (acre feet)	Acreage
Alice Fine sandy loam--	838C	Coarse-loamy, mixed, mesic Aridic Haplustolls	III-e	69.1	27.62	13.81
Cushman Loam------------	37C	Fine-loamy, mixed, mesic Ustollic Haplargids	III-e	66.7	0	20.04
Ft. Collins Loam------------	24C	Fine-loamy, mixed, mesic Ustollic Haplargids	III-e	289.4	0	57.88
Nelson Fine sandy loam--	438C	Coarse-loamy, mixed (calcareous), mesic Ustic Torriorthents	IV-e	357.6	0	107.4
Spearman Loam------------	347C	Fine-loamy, mixed, mesic Aridic Haplustolls	III-e	2.4	0	0.80
Thedalund Loam------------	136D	Fine-loamy, mixed (calcareous), mesic Ustic Torriorthents	III-e	191.9		115.11
	636D		III-e	65.8		39.47
	736D		VI-e	1.5	4.28	3.67
Wibaux------------	736D	Loamy-skeletal over fragmented, mixed, nonacid, mesic Ustic Torriorthents	VI-e	1.5		3.01
Totals------------				1,045.9	31.90	361.19

[1]Additional topsoil material considered suitable for salvage, but not included in the company proposal.

information is drawn from the company's permit application and the Big Horn County Area Soil Survey (U.S. Department of Agriculture, 1977). The average depth of soil which would be suitable for reclamation purposes is approximately 35 to 36 inches. The overall quality of the soil as a resource for rangeland and reclamation is fair to good. Much of the area supports stands of ponderosa pine. (See Vegetation, chapter II.) The Nelson, Alice, and Wibaux soils have properties as existing soils which make them particularly well suited for this purpose. These properties may not be transferable to the postmining surface. (See Vegetation, chapter III.)

Table II-7 summarizes available chemical data for the soils within the proposed 5-year mine plan area. The data are averaged from data in appendix B of the EIS on mining in sec. 36 (Montana Department of State Lands, 1977).

Data for pH, EC, and SAR values are subject to considerable revision. The State requires that these parameters be determined on saturated paste extracts, but the company's data are derived from 1:2 (sample:water) extracts, which represents a 5 to 6 fold increase in water and a dilution of dissolved salts. There is no consistent correlation between the two techniques of extraction. It is expected, however, that the EC values (salinity) derived from saturated pastes would be somewhat higher than those derived from 1:2 extracts. With revisions, the number of samples which would be saline (EC>4), alkaline (pH>8.8), or sodic (SAR>12) would probably not represent a significant reclamation problem.

Of the parameters measured and reported by the company only three instances fall outside the limits of the suggested State guidelines. These are the last increments sampled (74 to 84 inches) in the Alice Fine Sandy Loam which are texturally loamy sand, and one horizon of a Ft. Collins loam which is a silty clay. The company has not proposed the Alice series for salvage beyond a depth of 60 inches, and the silty clay horizon does not appear to be widespread.

The soils resource for the remainder of the 20 year mine plan (1985-97) is less well quantified than the soils which would be affected under the 5 year mine plan. Within the mapping units are inclusions which should be mapped separately in accordance with State guidelines. These inclusions are primarily coulee soils up to 10 acres in extent, and represent a significant resource, in terms of producing forage and cover for cattle and wildlife and as potential salvage for reclamation purposes. The soils, as mapped, do not differ significantly from those already discussed.

F. VEGETATION

The vegetation of Tract III is described by Westmoreland Resources, Inc. (1978) as containing five major groups: grasslands, ponderosa pine forest, riparian, agriculture, and miscellaneous disturbance types.

TABLE II-7.--Critical soil parameters of interest in salvage and reclamation[1]

Soil series	pH	EC*	SAR**	Boron (ppm)	Approximate texture
Suspect levels-----	(8.8-9.0)	(4-6)	(12)	(8.0)	40 percent clay, loamy sand and sand
Alice fine sandy loam-------------	7.5 (6.6-8.4)	0.6 (.4-.8)	0.8 (0.4-1.2)	0.5 (0.1-1.1)	Sandy loam (Loamy sand - sandy loam)
Cushman loam-------	7.9 (6.9-8.5)	0.5 (.3-.7)	1.0 (0.1-3.5)	1.1 (0.3-2.0)	Loam (Sandy loam - silty clay loam)
Ft. Collins loam---	7.4 (6.5-8.4)	0.5 (<.1-2.6)	0.3 (0.1-1.3)	1.0 (0.0-2.4)	Loam (Sandy loam - silty clay)
Nelson fine sandy loam-------------	7.7 (7.0-8.0)	0.4 (<.1-.9)	1.5 (0.1-8.2)	1.2 (0.8-2.0)	Sandy loam (Fine sandy loam - silt loam)
Spearman loam------	7.8 (7.1-8.5)	0.5 (.2-.8)	1.4 (0.2-3.1)	1.1 (0.3-2.2)	Loam (Sandy loam - loam
Thedalund loam-----	7.8 (7.1-8.3)	0.4 (.3-.6)	1.7 (0.1-2.7)	1.9 (1.0-3.0)	Clay loam (Clay loam - silt loam)
Wibaux Channery loam-------------	7.9 (7.4-8.1)	0.7 (.3-1.2)	1.4 (0.4-2.6)	0.9 (.6-1.1)	Loam (Sandy loam - loam)

[1]Single numbers are means of reported values for each soil series. Numbers in parentheses are the range of values reported by the company. Underlined results of analyses exceed State suspect levels.

*EC - Electrical Conductivity, mmhos/cm.
**SAR - Sodium Adsorption Ratio.

Within each major group, there are several community types and subtypes which are products of the area's flora interacting with the heterogeneity of the environment and the past management practices imposed upon this vegetation. The continuous disturbance of historic climax plant communities over the past three-quarters of a century by grazing and agriculture has decreased the distinctiveness of these communities, although increasing the species diversity within them (Daubenmire, 1968).

The grassland group is the most extensive of the native vegetation types within the 20-year mining plan. It is a combination of bunch-grass and short-grass prairie, with grasses and forbs the major elements, and shrubs as frequent associates. The grassland is a combination of several community types, each characteristic of a different topographic-edaphic situation. Important community types here, based on Soil Conservation Service range site classifications, are: silty, sandy, shallow, and thin breaks.

The ponderosa pine forest community type, topographically, is restricted to upper slopes, ridgetops, and certain drainage bottoms. Highest densities generally occur on north slopes where moisture conditions are most favorable. The ponderosa pine forest is differentiated by Westmoreland into two subtypes: closed canopy (greater than 75 percent canopy coverage) and open canopy (25-75 percent canopy coverage). Dominant species in the understory typically include bluebunch wheatgrass, Idaho fescue, Penn sedge, prairie sandreed, and side-oats grama.

Riparian types are considered to be those community types associated with drainage bottoms and resulting from enhanced moisture conditions. These types make up only a minor portion of the 20-year mining plan area; however, they are important as wildlife habitat and are therefore given particular consideration here. Of the eight riparian community types described by Westmoreland Resources, Inc., the snowberry-rose is the most extensive in the area. Snowberry-rose is generally restricted to mesic coulee bottoms and areas where winter snow accumulation results in better than average moisture conditions. The density of the snowberry stands limits the growth of most grasses, but Kentucky bluegrass is a common associate. Limited areas of shrub thickets, dominated by hawthorn, chokecherry and/or plum occur in drainage bottoms. Although limited in extent, shrub thickets provide food and cover for a variety of wildlife species.

Agricultural lands cover a large area of the 20-year mine plan. Most areas are planted in small grains; substantial areas of alfalfa hay support the ranching enterprise. Agricultural types identified within the 20 year mine plan include grass hay, alfalfa hay, small grains, and abandoned cropland.

Disturbed areas are those areas where activities of man, other than cattle grazing, have greatly altered the native communities. The vegetation at these sites exhibit various seral stages of plant succession toward the original climax state, as well as various introduced hay grasses and

ruderals (a weedy or commonly introduced plant growing where the native vegetation cover has been interrupted).

There are no known rare or endangered plant species in the Tract III area. This, however, does not preclude the possibility of endemic species, which may be rare and potentially endangered, having distributions within the area to be mined.

Problems with micronutrient deficiencies or trace element toxicities in livestock or wildlife are not known to occur in the Tract III area; however, there are no data available to confirm or refute this observation.

G. WILDLIFE

Within the Tract III area, the occurrence and interspersion of vegetation communities and the diverse topographic conditions provide good to excellent habitat conditions for about 160 wildlife species. While many of the small mammals, amphibians, and reptiles depend upon individual habitats to satisfy their requirements, the more mobile large mammals and birds depend upon the interspersion of contrasting vegetation types to satisfy their alternative needs (Daubenmire, 1968). Westmoreland Resources, Inc. (1978) has identified three major habitat complexes (figure II-7) which are correlated with the geology of the area and include:

- Plateau complex--southeastern part of the area; smooth to rolling topography, predominantly agricultural land use, some grassland and ponderosa pine.

- Clinker hills complex--central and northern parts of the area; rough topography and complex vegetation, including ponderosa pine on north slopes, skunkbush sumac on south slopes, grassland or sagebrush on gentle slopes, and riparian vegetation and springs in drainage bottoms.

- Lowland complex--western and extreme northeast parts of the area; creek bottoms and riparian vegetation, agricultural land, and some sagebrush.

Of the three habitat complexes, the most important is the clinker hills complex owing to the cover and diversity of the vegetation communities contained within it, the high diversity of wildlife species it supports, and its physical location between the plateau and lowland complexes. Springs and riparian vegetation in the upland drainages are of significant importance to many wildlife species as a source of food and water during the summer and fall months. These drainages may actually be of greater importance to wildlife than wintering areas (Peter Martin, Montana Department of Fish, Wildlife, and Parks, oral commun., July 1979). Mule deer, white-tailed deer and turkeys use the drainages as major migration routes between the plateau and lowland complexes.

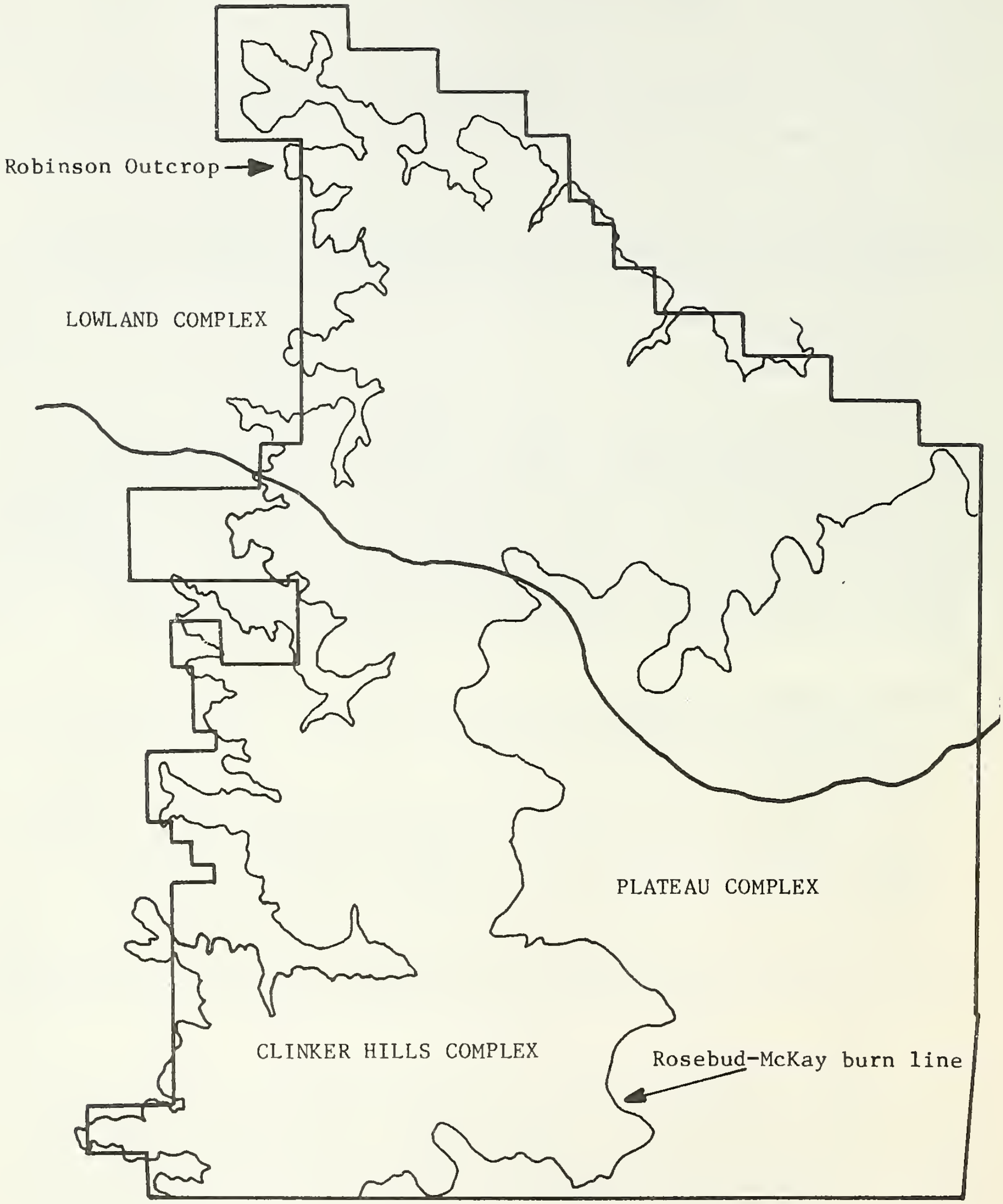

FIGURE II-7.--Major habitat complexes within Tract III.

Daily use patterns of the various habitat complexes are not well documented by company data; however, the proximity of observations in the other two complexes relative to the clinker hills suggest that many of the species use the plateau and lowland complexes for feeding and the clinker hills complex for escape cover, nesting, bedding, and water. Seasonal observations suggest that during the winter the clinker hills complex is the most heavily used complex by mule deer, white-tailed deer, turkeys, and sharp-tailed grouse. Although Westmoreland's data indicates that much of this use is concentrated in the area of the mine and facilities, other use areas such as a mule deer wintering area southeast of the proposed mine area (Peter Martin, Montana Department of Fish, Wildlife, and Parks, oral commun., July 1979) are expected to occur. During the spring and early summer, with the green-up of grasses and forbs, use patterns shift and more use of the lowland and plateau complexes is evidenced. Two sharp-tailed grouse leks occur in the proposed mine area--one within the 5-year permit area and one in the 20-year permit area. Nesting by many of the raptor species is also closely tied to the clinker hills complex; however, hunting activities by raptors are not necessarily tied to this complex. Late summer and early fall observations show a continued seasonal use of all complexes with a shift back to the clinker hills complex in late fall near the winter concentration areas.

Two endangered species, the bald eagle and the peregrine falcon, have been observed in the Tract III study area. These species have apparently used the study area to a limited degree during fall migrations. Only one sighting--that of a peregrine falcon in 1977--was within the proposed 5-year mining area. (See also FES 77-17 and Montana Department of State Lands, 1977.)

H. SOCIOLOGY

The study area for this discipline comprises a portion of Big Horn County, in which the Absaloka mine is located; the town of Hardin, in which most of the mine workers live; and the Crow Indian Reservation, which is mostly within Big Horn County. Hardin, the seat of Big Horn County and the largest town in that county, was incorporated in 1911. It is the nearest full-service community to the Absaloka mine. Big Horn County was created in 1913. Figure II-8 shows the populations of Hardin and Big Horn County beginning with the 1920 census. The following discussion is based largely on information in Mountain West (1975), Crow Tribe (1977), Montana Department of State Lands (1977), FES 77-17 (U.S. Department of the Interior, 1977), and the Big Horn County Comprehensive Plan (1974).

A portion of the Northern Cheyenne Indian Reservation is within Big Horn County, but is not expected to be affected substantially by the Absaloka mine. Previous studies and EIS's have not discovered any direct effects of the mine on the Northern Cheyenne, and the lack of transportation connections between the mine and the Reservation appear to preclude such effects.

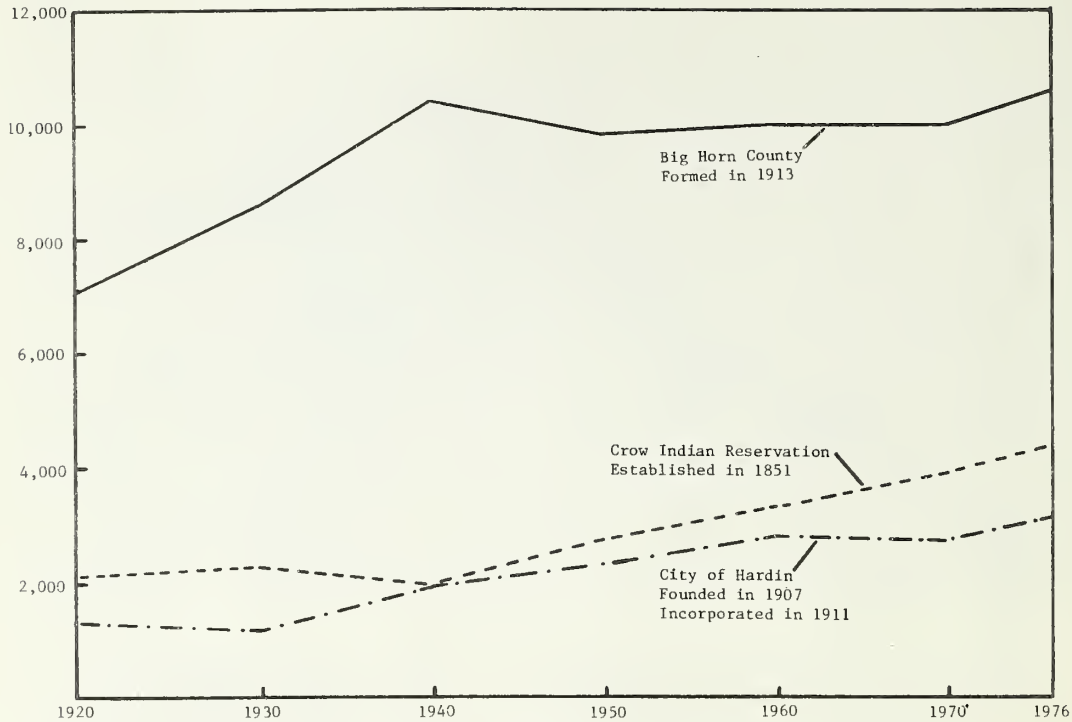

FIGURE II-8.--Population growth and decline in Big Horn County, Crow Indian Reservation, and the City of Hardin, 1920-76.

1. Population

Big Horn County was defined as a rural area by the U.S. Bureau of the Census until 1960, when the growth of Hardin changed its classification to urban. The county is still essentially rural, however. In 1950, there were about 1.9 people/mi^2 in the county; by 1976, the population density had only increased to 2.1 people/mi^2.

The population of the Crow Tribe historically declined until about 1940, when improved medical programs and facilities lowered the mortality rate among the Indians. The number of Crow Indians has increased since 1940. The white population of the county has been declining, following the nationwide trend of increasing mechanization in agriculture. In 10 to 15 years, assuming no further coal development and a continuation of existing trends, the numbers of Crow and whites in the county are expected to approximately equalize and stay nearly equal thereafter.

During the past century the Crow Reservation has become smaller: from 38.5 million acres in 1851 to 2.3 million acres at present. In 1970, 38.9 percent of Big Horn County's residents were Crow Indians; by

1976, the proportion had increased to 41.3 percent. The Reservation makes up about 75 percent of the land area of Big Horn County. Big Horn County has a much higher proportion of Indians than Montana as a whole--42 percent compared to 1.9 percent Statewide.

The number of males per 100 females (sex ratio) in Big Horn County was 100.7 in 1960, 98.5 in 1970, and 95.5 in 1976, showing the gradual trend of urbanization of the county. Urban areas typically have lower sex ratios than rural areas. In Hardin, the sex ratio was 95.7 in 1960, lower than in the county as a whole, and dropped further to 89.8 in 1976. This was the result of women moving to Hardin from surrounding rural areas, which is also typical of an urbanizing area.

Sex ratios among the Crow, on the other hand, have increased from 93.7 in 1960 to 95.6 in 1976. This trend is possibly the result of changes in the social organization of the Crow Tribe--changes which were perhaps brought about by new social and economic conditions due to the Absaloka mine. The nature of such social changes and the reasons for them are not known, however.

The median age of Big Horn County residents was 24.8 in 1976, although there are probably relatively few young adults. Many of the county's young adults leave to go to college and technical schools or to find jobs. The median age of Hardin's residents was 29.1 in 1976, because urban areas tend to have more older people, and because the Crow Indians make up a higher percentage of the county's population than Hardin's population. The median age among the Crow was 19.2 in 1976, indicating the relative youth and high growth rate of the population. The Crow population has a higher natural growth rate than the white population of the county.

From 1970 to 1976, the proportion of people in the 15-64 age group increased dramatically even though the overall sex ratio declined. (See table II-8.) This is probably due to single males and couples without children moving to Hardin as a result of the Westmoreland mine and related ancillary employment.

TABLE II-8.--Age distribution of Big Horn County residents

[Data are in percent]

Age category	1960 Male	1960 Female	1970 Male	1970 Female	1976 Male	1976 Female
Under 5------	12.8	14.7	10.9	11.1	9.8	9.0
5 to 14------	37.8	39.7	40.4	42.0	21.2	20.9
15 to 64-----	41.8	38.2	41.5	40.2	61.5	62.5
65 and older-	7.6	7.4	7.2	6.7	7.5	7.6
Total------	100.0	100.0	100.0	100.0	100.0	100.0
Sex Ratio--------	100.7		98.5		95.5	

2. Social Environment

The largest population group in Big Horn County is the Crow Indians. Although the Absaloka mine now depends primarily on Crow-owned coal, the mine is not on the Reservation. The mine has affected the Crow people mostly through the 71 Crow workers at the mine and through the royalities paid by Westmoreland to the tribe.

The social and cultural organization of the Crow Tribe is described more fully in reports by Mountain West (1975) and the Crow Tribe (1977). Of particular interest is the importance of the "extended family" among the Crow. Cousins, aunts, uncles, nephews, grandparents, and foster kin commonly take part in family activities. The average household size among the Crow is 5.17, somewhat larger than the average Crow family size (3.7), which is in turn larger than the average family size in the U.S. (2.97). The presence of a highly-paid mine worker in the family may possibly cause tensions and may potentially change relationships in the extended family. This may be a result of higher pay; the expectation to share wealth among family, clan, and tribal members; potentially enhanced influence and prestige of the mine workers engaged in dangerous occupations; and the effect of changes in established behavior patterns resulting from work schedules and the responsibilities of the job.

Educational attainment among the Crow is lower than the Montana average. Among Montana residents, 34 percent have a high school diploma, compared to 22 percent among the Crow. Increasing income from royalty payments would likely allow more of the Crow to continue their education, thereby improving their employment prospects.

No information is available to document any disruptive effects among the Crow society from the relatively small number of Crow working at the mine. Because the extended Crow family is generally larger than the nuclear white family, any adverse effects of having disparate incomes among the Crow could be expected to affect a greater number of people than in white families.

The Crow are organized into 12 clans which form the political bases of power in the Tribe. The clans have informally organized into various alliances on different issues, among them coal development on and adjacent to the Reservation. The traditionalists, who oppose mining on the Reservation, are not all opposed to mining on the adjacent Tract III. The Crow are thus divided on whether to promote additional mining on the ceded strip. Some of the Indians believe that mining will help them deal with economic and social problems on the Reservation, although there is little information on how the Westmoreland mine may have affected the cultural and social organization of the tribe to date. There are no strong indications that the royalities for the mine have substantially reduced poverty on the Reservation. The Crow's perception of how mining has affected the quality of their lives will affect their attitudes toward additional mining in the future.

Alcohol problems have increased in the predominantly white population of Colstrip following the opening of new mines and generating units there; it is not known whether similar increases have occurred in Hardin or the Reservation as a result of the Westmoreland mine.

The group of whites most concerned about and affected by the mine to date are the ranchers living adjacent to Tract III. Eleven ranchers lived near the mine in 1975 (Mountain West, 1975); those once living on Tract III having been bought out by Westmoreland. Problems which concern the ranchers (Montana Department of State Lands, 1977) are listed below. There is a general reluctance among local ranchers to discuss these problems, however.

- Too many people--over 100 workers commute daily to the mine.
- Pollution and visibility problems from the mine.
- Difficulties in moving cattle and equipment around the mine.
- Blasting, which shakes homes and has reportedly cracked plaster and broken windows.
- The breakdown of existing social relationships between locals, partly due to differences in attitudes toward the mine.
- The fear that mining will disrupt water supplies and interfere with agricultural operations.

Hardin has not been subjected to "boomtown" growth such as that experienced in Forsyth (the seat of neighboring Rosebud County) during the early 1970's. Social problems accompanying growth have not been acute. Growth in Hardin, while noticeable, has not caused problems such as overextended businesses or acute social disorganization. Slightly more than half of the mine workers have been local residents (Dave Simpson, Westmoreland Resources, Inc., written commun.), and the rate of growth has been such that newcomers have been fairly readily assimilated into the local social organization.

Some social and community services such as medical and mental health care were problems in Hardin and Big Horn County before the Westmoreland mine. (See Community Services.) Growth due largely to the Westmoreland mine has intensified such problems and has forced the community to find solutions sooner than they would have had to otherwise. As in most growing communities, Hardin has faced the problem of whether to expand facilities to anticipate growth when that growth may not occur; the excess capacity of the local high school is an example of such an expense to local residents.

There is no evidence to date that some of the groups which often suffer in energy-impacted communities (the elderly, those of fixed incomes, and minorities) have suffered as a direct result of the Westmoreland mine. Inflation appears to be no worse than non-impacted communities. Violence in Hardin related to feelings about the mine has not been reported, although there have been several cases of vandalism against property on and near the mine from unknown sources.

I. ECONOMICS

The economic conditions in Big Horn County are, in many respects, typical of those found throughout the Northern Great Plains. The differences that have occured have been almost entirely due to the concentration of low income persons on the Crow and Northern Cheyenne Indian Reservations. Lately, however, there have been changes that can be attributed to the increasing amount of coal mining that has been taking place in the county.

1. Employment and Income

The employment and income effects of the Absaloka mine are most evident in Big Horn County. Most of the wage earnings generated by the mine are spent primarily in Hardin, even though many consumer goods are purchased in Billings and Sheridan. Taxes paid by Westmoreland Resources, Inc. go to High School District 1 and Elementary District 17-H (figure II-9), Big Horn County, the State of Montana, and the Federal Treasury. Royalties are paid to the Crow Tribe of Indians and the State of Montana. The economics discussion in this EIS focuses on these affected areas.

Agriculture remains the main source of employment in the county, despite the continuing decline in the number of farm proprietors and employees. In 1972, 61 percent of the county's economic base employment was in agriculture; by 1977 this proportion had declined to 47 percent but was still the largest economic base industry. (See table II-9). The increasing employment at the Absaloka and Decker mines is rapidly becoming a more important source of economic base employment.

The county has a higher-than-average proportion of Federal government workers, mostly due to the Crow Indian Reservation. A relatively small proportion (about 34 percent compared to the State's 45 percent) of Big Horn County's total employment occurs in the trade and service industries. This results from the county's relatively low per-capita income--$4,552 in 1977 compared to the State average of $6,093--and because many residents shop in Billings and Sheridan for many of their needs. The per-capita income on the Crow Reservation, at $3,165, is the major cause of the county's low per-capita income.

Big Horn County has a higher unemployment rate than other counties in the Powder River coal basin or the State as a whole--6.3 percent, compared to 5.9 percent in Rosebud County, 4.1 percent in Treasure County, and 5.9 percent in Montana (Montana Department of Labor and Industry, 1979). This is due to the extremely high unemployment rate (49 percent in April, 1979) on the Crow Reservation.

Total personal income in Big Horn County increased by 48 percent between 1972 and 1977, mostly due to the Absaloka and Decker mines. However, because mine workers have much higher average incomes than workers in agriculture, government, or services (the other primary employers in the county), per capita personal income increased by only

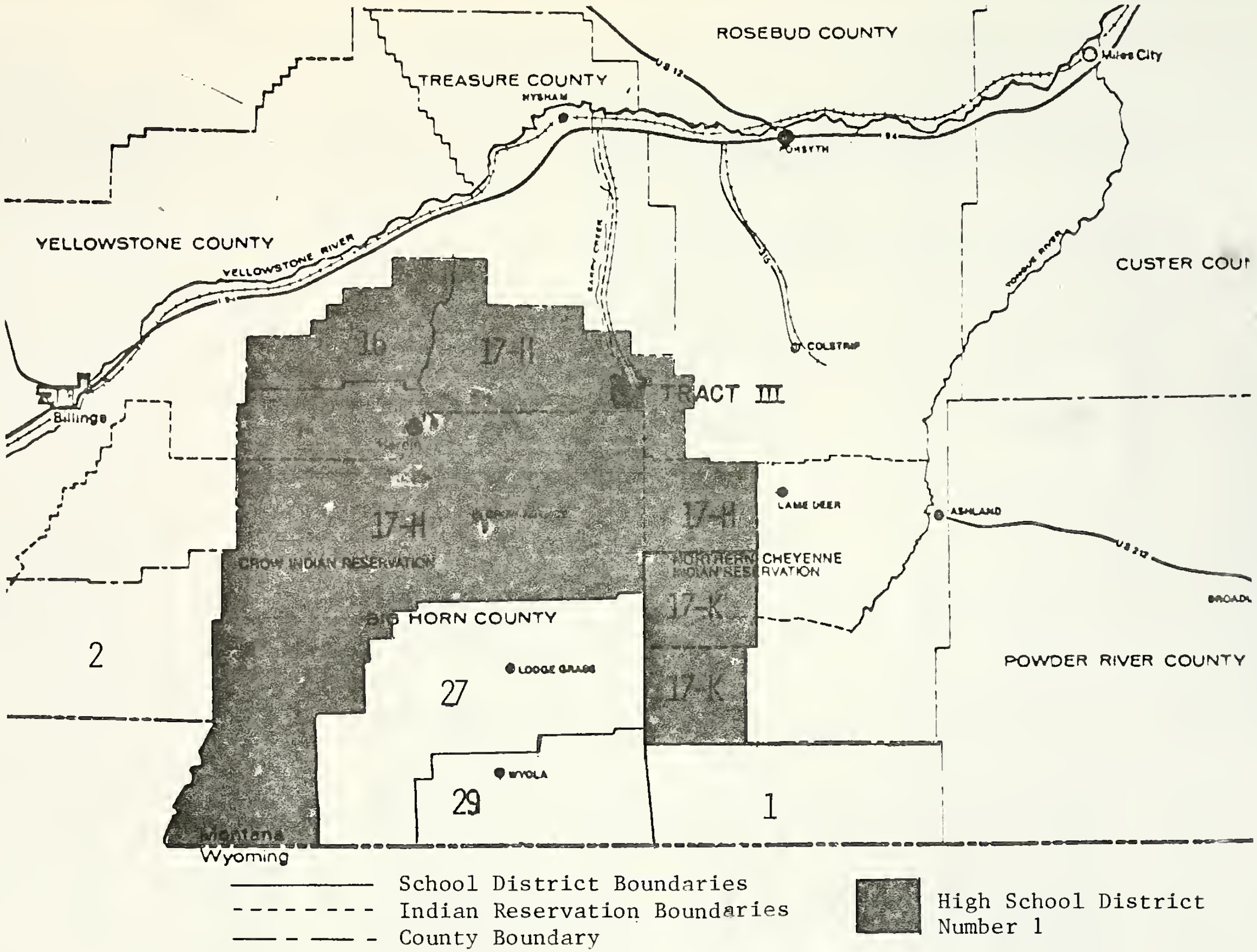

FIGURE II-9.--Big Horn County school districts.

TABLE II-9.--Employment by broad industry and sector, Big Horn County, 1972-77

[Source: U.S. Department of Commerce, 1979]

	1972[a]	1973[a]	1974[a]	1975[b]	1976[b]	1977[b]
Agriculture[1]	1,051	1,028	1,050	960	909	841
Mining	81	116	223	263	340	472
Manufacturing	143	121	71	38	49	32
Federal Government	451	432	492	516	449	453
Construction (part)[2]	0	0	0	0	0	0
TCU[3] (part)[4]	0	0	0	0	0	0
Total economic base sector	1,726	1,697	1,836	1,777	1,747	1,798
Trade	444	500	516	512	533	530
FIRE[5]	63	70	78	77	80	84
Services[6]	733	674	706	832	858	945
Construction (remainder)	191	157	169	145	102	242
TCU[3] (remainder)	89	99	106	104	111	108
Local and state government	503	527	553	565	577	593
Total ancillary sector	2,023	2,027	2,128	2,235	2,261	2,502
Total employment	3,749	3,724	3,964	4,012	4,008	4,300

[a]Estimates based on 1967 SIC code.
[b]Estimates based on 1972 SIC code.
[1]Farm proprietors plus farm wage and salary.
[2]Proportion greater than .0569 of total employment.
[3]Transportation, communications and utilities.
[4]Proportion greater than .0571 of total employment.
[5]Finance, insurance and real estate.
[6]Includes: other industry wage and salary and nonfarm proprietors.

43 percent. (See table II-10.) Assuming that inflation in Big Horn County was the same as inflation nationally, prices increased by 45 percent during the same period.

The royalties Westmoreland pays to the Crow Tribe have increased personal income of tribal members. The increased income in turn has had a relatively large derivative employment effect, primarily in and around Hardin. Total ancillary (derivative) employment increased by about 480 jobs between 1972 and 1977. (See table II-9.) About 150 of these jobs are a result of the income flows generated by the mine. Assuming that the ancillary employment has been derived in the same proportion as the income flows, about 100 of these jobs are due to the mine payroll, and about 50 are due to royalties paid to the tribe. These jobs are in addition to

TABLE II-10.--Personal income by major sources in Big Horn County, 1972-77 (thousands of dollars)

	1972[1]	1973[1]	1974[1]	1975[2]	1976[2]	1977[2]
Total labor and proprietor's income by place of work[3]						
By Type						
Wage and salary disbursements	18,019	18,902	22,915	27,162	28,036	35,592
Other labor income	900	1,074	1,584	2,274	2,908	4,016
Proprietor's income[4]	9,172	14,160	11,209	5,424	5,652	2,597
Farm	6,823	11,221	8,395	2,249	2,606	-649
Nonfarm[4]	2,349	2,939	2,814	3,175	3,046	3,246
By Industry						
Farm	9,235	13,949	11,643	5,194	5,169	1,645
Nonfarm	18,856	20,187	24,065	29,666	31,427	40,560
Private	12,002	12,895	15,523	19,730	22,572	29,963
Ag. Serv.,For., Fish., and other[5]	290	(D)	(D)	322	309	338
Mining	1,129	1,960	4,105	6,457	8,725	13,001
Construction	2,309	1,871	2,198	2,026	1,406	3,612
Manufacturing	1,086	873	569	380	452	381
Non-durable goods	1,000	793	505	208	268	174
Durable goods	86	80	64	172	184	207
Tranportation and Public Utilities	904	994	1,149	1,363	1,585	1,592
Wholesale trade	243	288	354	1,093	1,108	1,039
Retail trade	2,969	3,573	3,659	3,430	3,597	3,845
Finance, Insurance and Real Estate	608	663	631	702	913	1,044
Services	2,464	(D)	(D)	3,957	4,477	5,111
Government and governmental enterprises	6,854	7,292	8,542	9,936	8,855	10,597
Federal, civilian	3,851	3,955	4,835	5,688	4,132	5,363
Federal, military	130	137	145	158	153	166
State and local	2,873	3,200	3,562	4,090	4,570	5,068
Derivation of personal income by place of residence						
Total labor and proprietor's income by place of work	28,091	34,136	35,708	34,860	36,596	42,205
Less: personal contributions for social insurance by place of work	1,045	1,232	1,507	1,913	1,997	2,524
Net labor and proprietor's income by place of work	27,046	32,904	34,201	32,947	34,599	39,681
Plus: residence adjustment	-911	-615	-774	-1,689	-2,619	-5,062
Net labor and proprietor's income by place of residence	26,135	32,289	33,427	31,258	31,980	34,619
Plus: Dividends, interest and rent[7]	2,929	3,696	5,071	5,115	5,739	6,437
Plus: Transfer payments	3,785	4,347	5,022	6,076	6,931	7,537
Personal income by place of residence	32,849	40,332	43,520	42,449	44,650	48,593
Per capita personal income (dollars)	3,180	3,896	4,146	3,882	4,216	4,552

[1]Estimates based on 1967 SIC.
[2]Estimates based on 1972 SIC.
[3]Consists of wage and salary disbursements, other labor income and proprietors' income. Primary source of private nonfarm wages: ES-202 covered wages, Montana Employment Security Commission.
[4]Includes the capital consumption adjustment for nonfarm proprietors.
[5]Includes wage and salaries of U.S. residents working for international organizations.
[7]Includes the capital consumption adjustment for rental income of persons.
(D)Not shown to avoid disclosure of confidential information; data are included in totals.

the 165 basic sector jobs at the mine and the 75 workers currently assembling the new dragline.

2. Taxation

Property taxes account for most of the local public revenues in Big Horn County. The State also receives some property tax revenues but benefits to a much greater extent from the coal severance and personal income taxes.

Property taxes are administered by the Montana Department of Revenue under a complex system consisting of an assessment (usually based on market values), a statutory taxable value, and mill levies against the taxable value. The State income tax roughly parallels the Federal system (Montana Agricultural Experiment Station, 1978). Since 1975, three sources of revenue based on the contract sales price of coal have been available in Montana. The contract sales price is defined as the f.o.b. mine price less property, severance, and resource indemnity trust taxes charged to the seller.

The resource indemnity trust tax is an annual tax of $25 plus 0.5 percent of the contract sales price revenue in excess of $5,000 that is received from the sale of minerals, including coal, extracted from the State. Income from the trust account based on this tax will be available to the State for the first time in FY 1980. The gross-proceeds tax is a property tax that is calculated and distributed as such: each taxing jurisdiction applies its mill levy against the taxable value of the coal, i.e. 45 percent of the contract sales price. The coal severance tax is 30 percent of the contract sales price and is collected by the State and used for a number of activities (See table II-11). One of the effects of the mineral taxes is to pass part of the external costs of coal development on to the users of the coal and compensate future generations for the loss of a nonrenewable resource.

Big Horn County receives most of its revenue from property taxes. For example, in FY 1978, 63 percent of its revenue came from this source. Other important sources of revenue were the severance tax rebate (23 percent) and Federal revenue sharing (6 percent). The remainder came from many different sources including: fees, charges, licenses, permits, fines, and interest. The gross proceeds portion of the county's taxable value was $33,744,583--more than 62 percent of the total.

Montana elementary and high schools are supported by a complex combination of local, State and Federal funds. Finances for the general school budget consist of a complex foundation program, a permissive district levy, and a voted district levy. The maximum permissive budget level is established by State statute and varies by enrollment and type of school. It is called the "maximum" level because revenue flowing to it cannot exceed that amount. It is "permissive" because that level can be achieved without a vote. The foundation portion, which is 80 percent of the maximum permissive budget level, is supported by a statutory county levy, by the State equalization fund, and by State-wide deficiency levies.

TABLE II-11.--Disposition of the Coal Severance Tax collection according to 15-35-108, MCA

[Data are in percent of total collection]

	July 1, 1977-June 30, 1979	July 1, 1979-December 31, 1979	January 1, 1980-next change
Constitutional Trust Fund	25.0	25.0	50.0
General Fund	30.0	28.875	19.0
Local impact and education trust fund	19.875	28.125	18.75
Coal area highway improvement	9.75	0.0	0.0
State public school equilization	7.5	7.5	5.0
Alternative energy research, development and demonstration	1.875	1.875	2.5
Renewable resource development bond account (sinking fund)	1.875	1.875	1.25
Parks and art	1.875	3.75	2.5
Producing county	1.5	1.5	0.0
County planning (statewide)	0.75	0.75	0.5
State Library Commission	0.0	0.75	0.5

The trustees of any school district may complete the maximum permissive budget by using a permissive levy on the taxable value of property in the district. Each school district may vote a district levy to supplement or enrich the maximum permissive budget in order to complete the total general budget.

The foundation levy is 25 mills for elementary schools and 15 mills for high schools. The proceeds from this levy remain in the county unless the funds collected exceed the amount required for the 80 percent foundation

level, in which case the excess revenue goes into the State equalization fund. Therefore, large increases in taxable value such as those due to mining do not fully benefit the local school districts. The State equalization fund, which receives revenue from many different sources, is used to bring revenues up to the foundation level in counties where the foundation levy does not produce the required amount.

The permissive levy may not exceed 9 mills for elementary schools, 6 mills for high schools, or the level necessary to complete the maximum permissive levy (whichever is less). All revenues produced by the permissive levy remain in the school district and in cases where the 9 mill and 6 mill permissive levies fall short in completing the maximum permissive budget an additional State transfer to the school district can be made.

Voted levies (for which there are no statutory limits) in addition to enriching the general school budget, are also the primary source of funds used for capital outlay for school buildings and building sites. Grants from the Montana Coal Board have been made to the Hardin elementary and high schools and to the Lodge Grass high school for capital improvements.

Federal "title programs" also provide supplementary revenues to Big Horn County school districts. Public Law (P.L.) 874 is particularly important and in FY 1978 provided 25 percent of the general fund budget in district 17-H and 18 percent in High School District 1. (See table II-12.)

The Absaloka mine is located in school districts which have a substantial enrollment. (See figure II-9.) The mine is therefore subject to much higher property tax rates than the mines in southern Big Horn County, which are in school districts with low enrollments. Nearly 70 percent of both the elementary and secondary students in the county attend schools in the districts where the Absaloka mine pays taxes, i.e. Elementary District 17-H and High School District 1.

Unlike Elementary District 1 (where the Decker, Spring Creek, and proposed Pearl mines are located), which is at near-statutory minimum school tax rates, Elementary District 17-H has room for tax rate reduction and so would benefit from increases in its taxable value that occurred at a faster tate than increases in its enrollment. (See Economics, chapter III.)

Coal mining has been changing the composition of sources of school general funds in Big Horn County. The additional taxable value provided by the coal production has been steadily decreasing the amount of supplementary State equalization fund aid. In FY 1976 State funds amounted to $398,945 or 12 percent of the total county general school funds. By FY 1978 State aid had declined to $273,554 or 7 percent (See table II-12). This trend of increasing reliance upon locally generated revenues has been accompanied by steadily declining school taxes, from 67 mills in FY 1976 to 58 mills in FY 1978.

TABLE II-12.--Source of school general fund budgets in Big Horn County

[Source: Trustees Financial Summary 1975-76 and 1977-78]

	1975-76			1977-78		
	County total	Elementary District 17-H	High School District 1	County total	Elementary District 17-H	High School District 1
Receipts from district						
District levies	$ 603,934	$ 333,957	$ 213,990	$ 395,597	$ 57,062	$ 132,891
Tuition earnings	3,150	3,150	0	0	0	0
Interest	16,576	8,021	261	53,028	30,961	10,700
Miscellaneous receipts	2,271	1,203	958	16,380	1,810	1,013
Receipts from county						
County equalization aid	1,605,737	620,805	377,630	2,096,640	900,718	483,759
Receipts from State						
State deficiency levy	35,631	35,631	0	0	0	0
State equalization aid	175,059	116,895	0	121,390	79,315	0
State impact and bonus payments	0	0	0	0	0	0
State permissive levy	188,255	93,844	13,538	152,164	71,029	0
Receipts from Federal Government						
Federal impact (P.L. 874)	589,230	252,844	73,993	1,151,153	386,317	134,104
Total receipts	3,219,843	1,465,706	680,370	3,986,352	1,527,212	762,467

The City of Hardin is currently levying 65 mills, the maximum allowed by law. If Hardin's need for additional revenues grows at a faster rate than the tax base, the city's constant dollar per-capita revenues will fall. A decline in the city's per-capita revenues will reduce its ability to provide needed services. (See Economics, chapter III.)

J. COMMUNITY SERVICES

The following discussion is based on information in McQuiston, 1979, and in DES 79-41 (U.S. Department of the Interior and Montana Department of State Lands, 1979).

Impacts on community services from the Westmoreland mine would be confined to Big Horn County, where nearly all of the population increase from the mine would occur. Most of Big Horn County's growth would occur in Hardin; therefore, the discussion of the current situation focuses on Hardin.

1. Housing, Water, and Sanitation

Hardin has a housing shortage which is directly related to an outdated sewage disposal system. The existing sewage disposal system in Hardin is functioning at maximum capacity; a new sewage system is planned for completion by 1980 under a grant by the State Coal Board. This facility should provide adequate sewage disposal for both new and existing housing.

Wyola does not have a community sewage disposal system. The sewage system in Lodge Grass is adequate.

A solid waste disposal system is being installed which will handle refuse in Big Horn, Rosebud, and Treasure Counties. Big Horn County will have eleven 40-cubic-yard solid waste canisters in rural communities which will be transported to a sanitary landfill in Hardin.

Existing water supplies in Hardin and Lodge Grass are adequate. Wyola utilizes individual wells for water, but does not have problems with well contamination.

2. Fire Protection

Hardin's fire department provides adequate fire protection. The department operates on 1 mill of city taxes and could increase 1 additional mill. The county fire department operates under the county sheriff. Its firemen consist of county work crews and deputies. The county recently obtained two new fire trucks using Coal Board funds. Water pressure in Hardin is not adequate to handle large fires and residents are occasionally asked to turn off their water during large fires.

3. Education

The Hardin School District has adequate facilities at present. The high school has more space than is needed, a costly condition for the district. Teachers have a relatively high turnover rate.

4. Public Welfare

The Big Horn County welfare office lacks the funds to adequately do follow-up work and counseling necessary for complete service. Recruiting and retraining social workers is difficult. There is a shortage of group homes and foster homes for children, teen-agers, adults, and the developmentally disabled. Welfare administrators report that other needs of the county include: a rape/crisis team, vocational training facilities for young school drop-outs and adults, a local Employment Service office, health educator and nutritionist, and a shelter for alcoholics.

5. Public Health

The small hospital in Hardin is understaffed and does not adequately serve the county's population. The number of physicians is about one fourth of the national average for the county's population. Because major hospitals are located at a considerable distance in Miles City, Sheridan, and Billings, health service for people in remote rural areas is a problem. Big Horn County has a public health nurse, and community health medics are certified to help Crow tribal members.

Mental health and drug abuse programs in Big Horn County are understaffed and underfunded. Residents are served by the mental health center in Billings, but this center must serve a large area. Hardin has one drug-abuse caseworker in addition to professionals from the Billings center.

6. Law and Equity

According to DES 79-41, the criminal justice system in the southeast Montana coal area is not efficient. Although crime rates are within the normal range for rural counties (see table II-13), broad reforms are needed to improve jails and ease delays in criminal proceedings. Police officers are often attracted to the higher pay at the mines. FES 77-17 (U.S. Department of the Interior, 1977) describes the criminal justice system in the county and on the Crow Indian Reservation.

K. LAND USE

The land use pattern in Big Horn County is dominated by agriculture and is similar to the rest of the rural Northern Great Plains. The Absaloka mine is located in an area that reflects the general Big Horn County pattern. (See figure II-10 and table II-14.)

TABLE II-13.--Comparison of crime rates[1] for Big Horn and Rosebud Counties, 1969-77

[Source: Montana Board of Crime Control, 1977]

	County	
	Big Horn	Rosebud
1969---	1,321.7	111.0*
1970---	1,312.5	256.3*
1971---	1,549.4	1,580.0
1972---	1,133.3	1,539.0
1973---	951.3	2,066.7
1974---	741.6	2,969.6
1975---	1,386.0	3,128.0
1976---	1,236.4	3,111.3
1977---	4,166.4	8,813.0

[1]Crime rate is the number of crimes per 100,000 population.

*May not be accurate.

TABLE II-14.--Land use in Big Horn County

[Source: U.S. Department of Agriculture, 1972]

Use	Acres	Percent of total
Cropland-------------	286,480	9.0
Pasture and hayland--	42,430	1.3
Rangeland------------	2,501,257	78.8
Forest---------------	331,721	10.6
Other*---------------	10,997	0.3
Total--------------	3,172,885	100.0

*Includes water areas, urban and built-up, roads, and railroad rights-of-way.

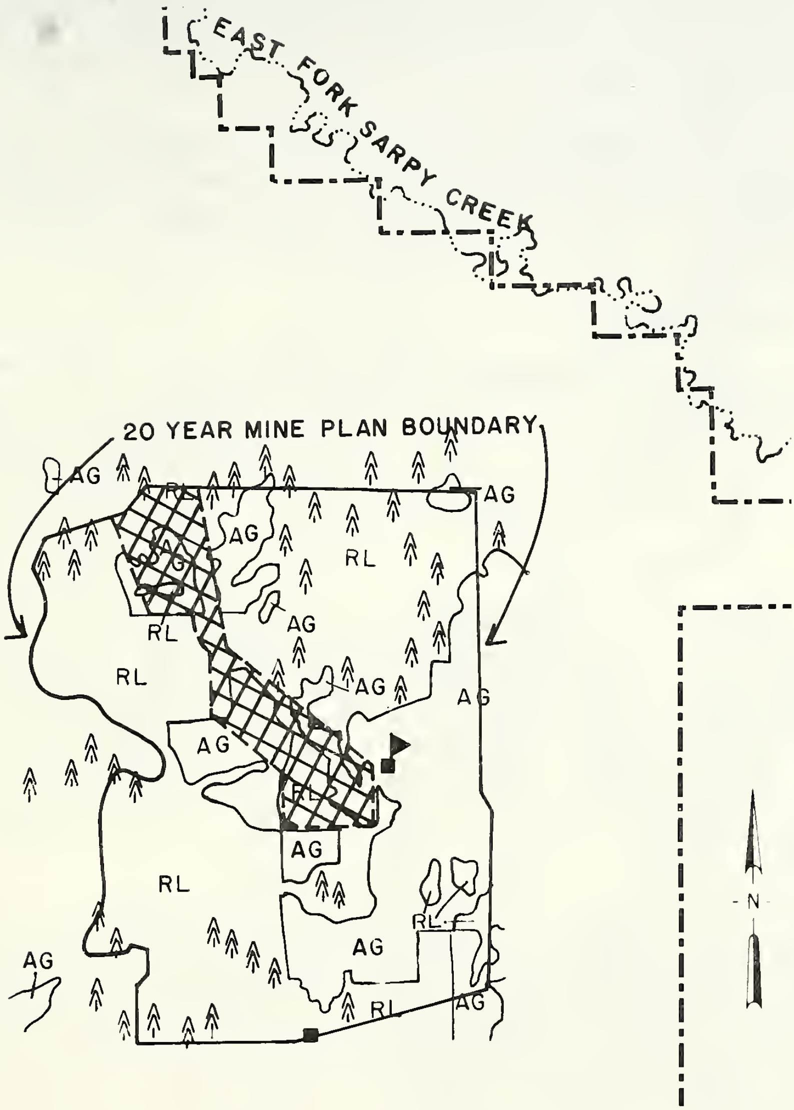

FIGURE II-10.--Premining land use within the 20 year mine plan area. "RL" indicates rangeland; "AG" indicates agricultural (alfalfa hay, small grains, and tame pasture); tree symbol indicates ponderosa pine (partly rangeland). Dashed lines show the boundary of Tract III.

The rangeland in the mining area, because of its diverse vegetation and many springs, is generally more productive than the regional average. The area is capable of supporting 0.38 animal unit months (AUM's) of livestock grazing per acre, compared to the average of 0.25 AUM's/acre in the 80 State-owned sections nearest the Absaloka mine (Montana Department of State Lands, 1977).

To date, the Absaloka mine has disturbed about 920 acres (table III-4). Reclamation is underway on some of this disturbed land, but the performance bond has not been released. The earliest the company can apply for bond release on currently disturbed lands is 1980.

L. TRANSPORTATION

Due to the sparse population and widely separated towns, most people and consumer goods in the study area move by roadways. (The study area for this discipline includes Big Horn County, Treasure County, and the road and rail corridors along the Yellowstone River.) The road network is not well developed but is generally adequate for the existing population. Figure II-11 shows the transportation routes in the area.

1. Highways

Interstate 90, the major north-south artery, lies 27 miles west of the mine area. Interstate 94, the main east-west artery, lies about 30 miles north in the Yellowstone Valley near Hysham. U.S. Highway 212 (Federal Aid Primary 37) passes east-west about 25 miles to the south. Montana Highway 315 (Federal Aid Primary 39) is paved and connects Interstate 94 and U.S. Highway 212 about 30 miles to the east of the area through Colstrip. Federal-Aid Secondary (FAS) Route 384, the main road to the Westmoreland mine area, leaves Hardin and travels northeasterly 27 miles to the mine, then heads directly north to Interstate 94 near Hysham.

Paving and upgrading of 11 miles of FAS 384 between the Treasure County line and Hardin is currently underway. Projected improvements would extend paving from the point where it now ends (21 miles east of Hardin) to Spring Creek junction and northward toward the Big Horn-Treasure County line. This construction is scheduled to be completed in the fall of 1979, and will provide a paved road from the Westmoreland mine to Hardin, where most of the mine workers live. The up-grading will help accommodate the 300 to 400 percent increase in traffic that has occurred since 1970 on the Big Horn County part of the highway. The funding for the road is 22 percent State and 78 percent matching Federal monies. The Treasure County segment of FAS 384 from the county line to Hysham (approximately 25 miles) is now mostly gravel, although one small section is paved. The Treasure County portion of FAS 384 is scheduled to be upgraded starting in January, 1980. (Bob Keck, Montana Department of Highways, oral commun.; FES 76-64, U.S. Department of the Interior, 1976.)

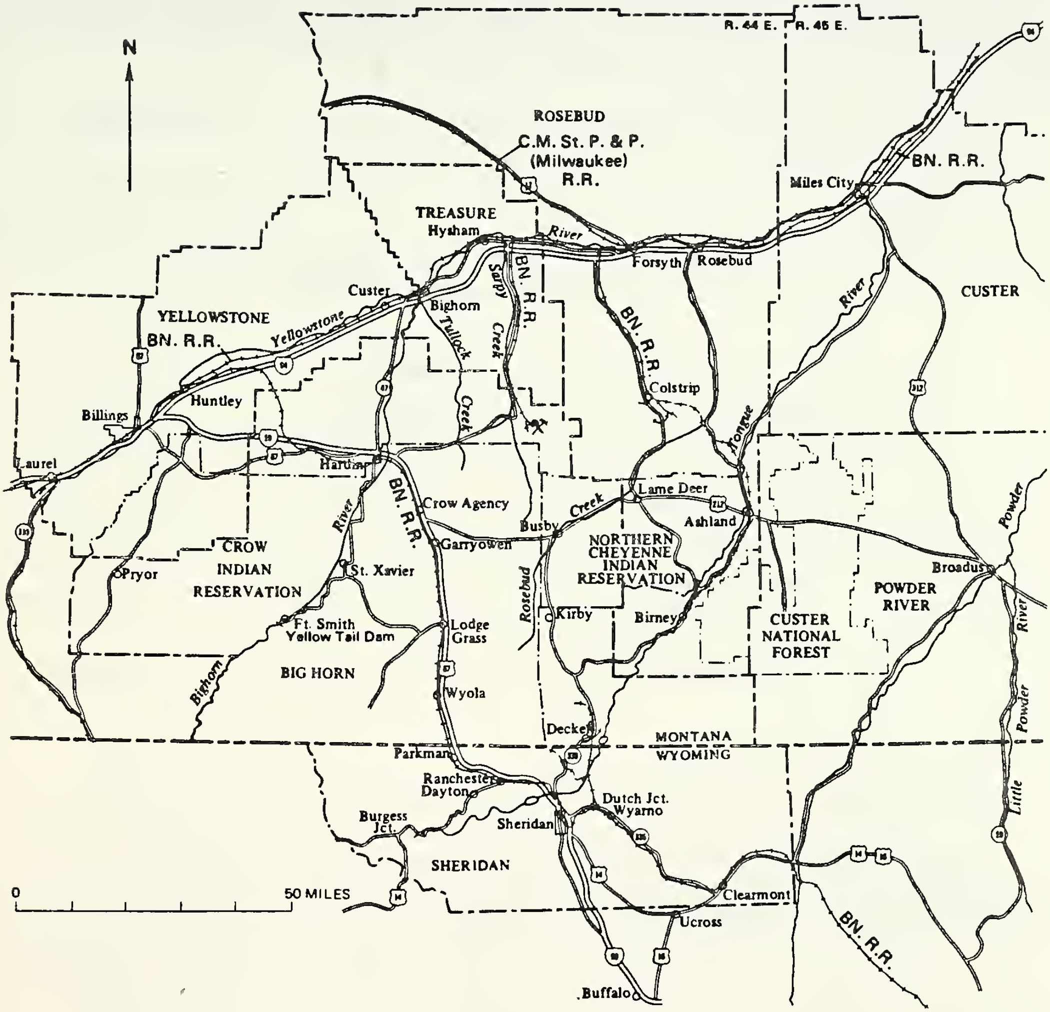

FIGURE II-11.--Transportation routes in the Absaloka mine area.

Big Horn County Road No. 55 currently runs east from a point near the Spring Creek junction on FAS 384 through the Sarpy Creek mine area and terminates approximately 10 miles east of the mine. The county road is gravelled and services the mining office, the mine proper, and local ranches in the East Sarpy Creek area. Traffic is heaviest during mine work shift changes, and ranchers and miners sometimes compete for the road, particularly when livestock is moved along the road. During summer months the road is moderately dusty. At this time the road is being relocated to the north of its present location.

Table II-15 shows the average daily traffic counts for rural road sections in the study area, and trends from 1970-78.

TABLE II-15.--Average daily traffic counts for highways in vicinity of the Absaloka mine, 1970-78

[Source: Philip Colbert, Montana Department of Highways, oral commun.]

Highway	1970	1974	1978
FAS 384 (2.5 miles east of Hardin)---	326	445	472
15 miles east of Hardin---------	99	332	347
Spring Creek Junction----------	57	219	322
16 miles south of Interstate 94-----	35	65	70

2. Railroads

The nearest major railroad is the Burlington Northern (BN) main line along the Yellowstone River 36 miles to the north. A branch line of the BN extends from the Decker mine to Sheridan, Wyoming, and a spur line extends from Forsyth to Colstrip. (See figure II-11.)

The Absaloka mine is connected to the BN main line at Sanders via a spur along Sarpy Creek. This spur terminates in a loop at the mine's coal handling facilities. At the current production level of 5.3 mty, about 20 unit trains/week (including returning empty cars) travel the spur line between Sanders and the Westmoreland mine. From Sanders the unit trains move eastward along the BN main line to Minnesota and Illinois where some of the coal is transferred to barges (table I-4).

To date the spur line from the Westmoreland mine to Sanders has had an accident-free record. This can be attributed to the few rail crossings

and the relative remoteness from population centers along the line (David Morgan, Montana Department of Highways, oral commun.).

Traffic on the BN main line appears to be within capacity. During the winter of 1977-78, however, ice on the Mississippi River prevented barges from moving and interrupted shipments of coal. Because of this, production from mines in the Powder River basin, including Westmoreland, was curtailed about 9 percent during 1978.

M. RECREATION

Because of the rural nature of the Tract III area, recreational use is oriented towards outdoor activities such as hunting, hiking, snowmobiling, and horseback riding. All of the land in this area is private or State-owned and public access and recreational opportunities are, therefore, limited. Most of the recreational use of the Tract III area is by local residents.

Several urban recreation facilities are available in Hardin. Three city parks, the schools, and other facilities provide the residents with swimming and wading pools, basketball courts, tennis courts, an ice skating rink, ball fields, picnic grounds, playground equipment, and horseshoe pits. Privately owned facilities include a bowling alley, a 9-hole golf course, a theatre, and a drive-in movie (Montana Department of State Lands, 1977). Most of these facilities are not presently being used to capacity. Because impacts are not anticipated in Crow Agency and Lodge Grass, the facilities in these towns are not discussed.

N. CULTURAL RESOURCES

1. Archeology

In 1972, an intensive inventory of the archeological sites in Tract III was conducted for Westmoreland, and in the summer of 1975, additional surveys were completed (Westmoreland Resources, Inc., 1978). These surveys resulted in the identification of 44 sites, only 2 of which are within the proposed 20-year mine area. The types of sites found included occupation sites, observation sites, quarry sites, rock art sites, stone ring sites, rock cairns, and chipping stations. (See U.S. Department of the Interior FES 77-17, 1977, and Montana Department of State Lands, 1977).

The archeologic sites within the proposed 20-year mine area have been reviewed for eligibility for inclusion on the National Register of Historic Places and have been determined not eligible (appendix B).

2. Historic

Prior to the homestead era, the history of the Sarpy Creek area is very sketchy. In 1975, Westmoreland conducted a survey of the historic

resources on Tract III. Although many sites of historic interest are present in the general area, only six historic sites within the proposed 20-year mine area have been identified. The names and locations of the sites, all in T. 1 N., R. 38 E., are:

Dychman Ranch - SE 1/4 SE 1/4, Sec. 30
Second Sarpy School - NW 1/4 SE 1/4, Sec. 25
Jesse Wolf Place - SE 1/4 NW 1/4, Sec. 30
Old Homestead - NW 1/4 SW 1/4, Sec. 30
Charles Hite Place - E 1/2 SW 1/4, Sec. 19
Rial Roberts Place - NW 1/4, Sec. 31

(See U.S. Department of the Interior FES 77-17, 1977; and Montana Department of State Lands, 1977.) These sites have been reviewed for eligibility for inclusion on the National Register of Historic Places and have been determined not eligible (appendix B).

O. ESTHETICS

The Tract III area can best be described as a rural area of grazing and agricultural land with average esthetic values. Although mining in the area diminishes the overall scenic quality of the area, it is not so extensive nor visible as to entirely negate this quality. The interaction between the rolling hills and deeply dissected plateaus, the vegetation patterns, the rock outcrops, the drainage courses, and the man-made structures lends itself to the generally pleasing esthetic quality of the area. (See U.S. Department of the Interior and Montana Department of State Lands, DES 79-41, 1979, and U.S. Department of the Interior FES 77-17, 1977.)

CHAPTER III

IMPACTS OF WESTMORELAND'S PROPOSAL

This chapter describes the environmental impacts of the mining and reclamation plan (hereinafter termed "mine plan") proposed by Westmoreland Resources, Inc. The analysis considers those mitigating measures specifically proposed by Westmoreland as part of the permit application. (See chapter I.) Additional mitigating measures which could be required to meet existing laws and regulations are described in chapter VIII.

Each section of this chapter begins with a summary of the anticipated environmental impacts, as measured by the degree to which the impacts would benefit or interfere with the anticipated uses of each resource. Impacts which would severely interfere with the uses of a particular resource are termed "significant". For example, a significant impact on water resources would cause relatively severe conflicts with anticipated uses of water.

The summary of each section is followed by a documentation and explanation of its conclusions. The summary and documentation are separated by a double underscore (__________).

A. GEOLOGY

1. Topography and Geomorphology

Geomorphic impacts under the 5 year mine plan would be moderately significant although some of the erosion expected from the reclaimed land surface could be avoided. The overly long, straight slopes would erode excessively in their upper reaches and deposit sediment on lower portions of the reclaimed surface, thus inhibiting revegetation and subsequent postmining land use on as much as three-fourths of the mined area. Some erosion and sedimentation could not be avoided, however.

The company has submitted a revised postmining contour map (July 12, 1979) on which the slopes have not been significantly changed from the previously designed straight and convex configuration. However, in an inserted legend (Detail 1) they indicate that all slopes would be constructed as convex-concave slopes. The Department has sent a letter to the company requesting a statement on the intent of the company regarding the postmining configuration of reclaimed slopes. If this is accepted as a commitment and is accomplished as stated, the following discussion on slopes morphology would not apply.

Avoidable accelerated erosion and sedimentation would be due to the creation of geomorphically unstable slopes and drainages; alterations of soil and spoil hydrologic properties affecting infiltration and percolation rates; and excessive soil degradation through storage. Unstable slopes and drainages, because of their low gradients, would erode slowly and continuously for perhaps decades until a new equilibrium is reached.

The avoidable problems could largely be alleviated through redesign of the reclamation plan.

Westmoreland currently proposes long, straight slopes bounded on the lower end by convex drops to the drainage bottoms. Such a slope configuration would promote surface erosion (Hadley and Toy, 1977; Young and Mutchler, 1969). Erosion could be minimized by redesigning the proposed postmining land surface. (See Technical Alternatives, chapter VIII.) Several drainages would converge on reduced surface gradients, thereby promoting sedimentation. Rapid sedimentation would inhibit revegetation in affected areas. (See Soils and Hydrology.)

Current erosion and sedimentation rates on reclaimed surfaces at the Absaloka mine reflect the importance of proper geomorphic design of the postmining surface. There are several reclaimed areas with complex (convex-concave) slopes which exhibit little or no severe erosion. There are also reclaimed areas with long, straight slopes exhibiting comparatively severe erosion. In some instances, past management practices have aggravated the situation, resulting in notices of noncompliance (Brace Hayden, Department of State Lands, oral commun., 1979). Inasmuch as the current reclamation plan proposes long, straight slopes, frequently with convex toeslopes, it is reasonable to assume that significant (although avoidable) erosion problems would occur. Other factors influencing reclamation surfaces are discussed in the sections on soils and surface hydrology in this chapter.

Avoidable accelerated erosion and sedimentation would also occur as a result of roads and associated drainage ditches proposed to be left through the reclaimed drainage bottoms. They would serve as substantial sediment sources and efficient sediment and runoff transport channels from the reclaimed area. The roads and ditches would most likely be required if the 20 year mine plan is eventually approved, however, making this component of the total erosion and sedimentation unavoidable.

Under the 20 year mine plan, geomorphic impacts would probably be significantly more severe and complex. The loss of many springs and destruction of the current ground water system (see Hydrology), in conjunction with decreased vegetation in the coulees and increased runoff from the postmining surface, would likely establish an ephemeral surface water drainage network which does not currently exist. The creation of active ephemeral channels from the reclaimed surface to East Fork Sarpy Creek would result in increased erosion in undisturbed coulee bottoms, as well as increased sediment loads to East Fork Sarpy Creek. These impacts would require possibly several decades to a century to fully develop.

Unavoidable erosion and sedimentation on the reclaimed surface would be due to the disturbance of soils, grading and compaction of the postmining surface, and increased water runoff. These problems are typical of any surface mine in a semiarid environment, and would last indefinitely until an equilibrium is reestablished.

2. Mineral Resources

Under the 5 year mine plan (1980 through 1984), 39.5 million tons of coal would be mined from approximately 345 acres within Tract III. Under the 20 year mine plan (1978 through 1997), 180 million tons of coal would be mined from about 1,980 acres within Tract III and the State-owned section 36. About 23 million tons of coal would not be recovered, owing to the limits of present technology (U.S. Department of the Interior, 1977).

The coal mined under the 20 year plan would amount to 30 percent of the total economically recoverable reserves in Tract III, and about 1/2 of 1 percent of the estimated strippable reserves in the northern Powder River coal basin. Mining would recover about 90,500 tons/acre--about average for strip mines in southeastern Montana.

3. Other Geologic Impacts

The existing stratigraphy down to the lowest coal seam mined would be replaced by a mixed mass of broken rock with greater porosity and permeability. The existing stratigraphy, however, is not unusual and has no intrinsic value.

Mining would not interfere with development of other minerals: none of significance are known at the minesite. Any possible reserves of oil and gas would occur in rocks beneath those to be mined. Clinker, sand, and gravel would be disturbed by mining, but these materials are common throughout the region. Mining would not create any geologic hazards of consequence. Coal fires would be a potential hazard during mining; the hazard would be minor, because Westmoreland is committed to extinguishing fires when they occur. After reclamation, coal fires would be highly unlikely.

No paleontological resources of importance are known to exist in the rocks of the Fort Union formation that would be mined.

4. Overburden

The spoils resulting from the removal and regrading of overburden and interburden have the potential of creating reclamation problems. However, the mining and reclamation plan is designed to place part of the more desirable overburden at the surface. In practice, this approach has proven to be successful. Spot checks in June of 1979 of topsoiled spoils considered most likely to exceed State guidelines have shown clay, SAR, pH, and EC to be within acceptable limits.

There is a degree of mixing of overburden and interburden at the mine which results in higher than anticipated percentage of clay. High clay content limits infiltration rates, increasing runoff and erosion. Limited percolation through the spoils causes formation of rills and gullies as well as accelerated sheet erosion, causing high rates of

topsoil loss. In extreme cases, piping may result from water flow between spoils and topsoil. Erosion is also a function of slope characteristics. The interrelationships among and between spoil texture and mineralogy, topsoil texture, mineralogy and depth, and slope morphology cannot be quantified at the present time. Plant cover and density also affect erosion rates, but are not the controlling factor in a semiarid environment.

The relatively high clay content in the regraded spoil may be mitigated to a considerable, but presently unquantifiable, extent by the creation of stable complex or convex-concave slopes. (See Geomorphology.)

Chemically, the major problems associated with both overburden and interburden materials are frequent elevated values for extractable nickel (Ni) and molybdenum (Mo). Based on a discussion in Underwood (1977) it does not appear as though Ni poses a significant threat to animal life feeding on the reclaimed surface.

B. HYDROLOGY

Impacts on the hydrologic system would be significant, because mining would destroy part of a recharge area that supports numerous springs in three coulees north and northeast of the mine area. Drawdown from the mine pit, both during and after mining, would further reduce groundwater flow toward the springs. Loss of the springs and the associated drop of the groundwater table would affect vegetation, wildlife, and land use in and adjacent to the coulees. Impacts under the 5 year mine plan would be more localized than under the 20 year plan; under the latter, East Fork Sarpy Creek could well be measurably impacted.

1. Surface Water

The most significant impact on surface water under the 5 year mine plan would be the loss of numerous springs in the upper coulees tributary to East Fork Sarpy Creek. (See Ground Water.) Spring 276 would be destroyed and the following springs would probably experience decreased or total cessation of flow as a result of a significantly lowered water table: 232, 261, 262, 263, 264, 265, 274, 275 and 277 (figure II-1). Lesser decreases in flow could well occur in springs 271, 272, and 273. Other springs in the vicinity are expected to be unaffected by mining. The loss of these springs would be significant because the overall use of the coulees would thereby be limited. (See Land Use, Vegetation, and Wildlife.)

Eventual approval of the 20 year mine plan would physically remove all of the above listed springs, as well as springs 260, 266, and 277. In addition, springs 223, 271, 272, and 273 would experience a marked decrease or cessation of flow. (See Ground Water.)

Because most or all of the affected springs do not maintain surface flow very far down-coulee, surface water impacts due to mining would be limited to those caused by the local loss of the springs. No direct impact is likely on the intermittent surface flow of either East Fork or Middle Fork Sarpy Creek. Direct impacts on those streams are discussed under Ground Water.

Primary surface water impacts during mining would be the loss of surface runoff from the mining area. State and Federal regulations limit the surface discharge from mining areas, and accordingly, Westmoreland proposes to construct impoundments to control surface runoff from the mine. Under both the 5- and 20-year mine plans, loss of surface runoff to the Sarpy Creek basin would amount to less than 1 percent. This loss would be insignificant, because most or all runoff from headwater tributaries is lost to infiltration and evapotranspiration. Furthermore, sedimentation impoundments outside the mine pit would in most cases lose their containment by infiltration, thus allowing the same thing to occur to surface flow as would have happened naturally.

After mining, surface runoff from the reclaimed surface is expected to increase by a measurable, although unpredictable, amount (Lusby and Toy, 1976). The total increase in surface flow resulting from reclamation under the 5 year mining plan would be a negligible change in the runoff of the East Fork drainage basin. Reclamation under the 20-year mine plan may measurably increase peak runoff flows to East Fork Sarpy Creek, but at the expense of base flow. This should not cause any measurable impacts to downstream agricultural operations.

Surface water quality impacts under the 5-year plan would be negligible during mining. This is because all surface runoff from the mine area would be intercepted and treated, if necessary, prior to discharge beyond the mine perimeter. The Montana Department of Health and Environmental Sciences has issued two surface water discharge permits to Westmoreland Resources, Inc. Current discharge from the mine area is rare, however, and periodic water quality monitoring to date has revealed no water quality problems.

Reclamation under the 20-year mine plan would probably eventually result in increased total suspended sediment concentrations in East Fork Sarpy Creek (see Geomorphology, chapter III), although the extent and the timing of the increase is not certain.

Direct and indirect water consumption due to the mine would not conflict with other uses of water in the area. The Absaloka mine currently consumes about 150 acre-feet of water per year, most of which is obtained from the deep Madison aquifer. By 1984, when the full coal production level is reached, consumption at the mine would reach about 280 acre-feet/year from the same source. Indirect consumption by the additional population induced by the mine (mostly in Hardin) would amount to 130 acre-feet in 1984. By the year 2000, indirect use would be about 360 acre-feet/year and would be greater than the direct use at the mine. With this increase,

Hardin's total water use would be on the order of 500 acre-feet/year--well within its current water rights of 10,900 acre-feet/ year. (See DES 79-41, U.S. Department of the Interior and Montana Department of State Lands, 1979.) Water supply to the town of Hardin would continue to be adequate, although the occasional problem of inadequate pressure during large fires would presumably become more frequent. (See chapter II, Community Services.)

2. Ground Water

a. 5-year mine plan

The most serious impact which would occur on the ground water system under the proposed 5-year mine plan would be the marked alteration of the ground water flow which supports numerous springs occurring in the heads of three coulees draining northward and northeastward from the mine area. (See Surface Water.) This impact would be significant because it would permanently reduce ground water flow toward and within those three coulees and would therefore sharply limit their future use by lowering the ground water table. (See Land Use, Vegetation, and Wildlife.)

The impact would occur because the overburden to be removed by mining is the source of the ground water supplying most of the springs in the heads of the coulees. Approximately 40 percent of the recharge area for the springs would be removed under the 5-year plan; however, impact on the springs would probably be much greater, because the hydraulic head and the majority of the recharge bedrock volume compose the 40 percent to be removed. The primary cause, however, would be due to drawdown created by the pit which would dewater a considerable amount of undisturbed overburden. For example, dewatering would extend 1,000 feet from the edge of the pit within about 1 year (Dames and Moore, 1977) and would continue at a diminishing rate until a new ground water divide and equilibrium are established. The precise location of this divide and its timing cannot be determined at this time. The ground water system would be most heavily impacted at the coulee heads, where the ground water which supports the springs would be diminished. Impacts would decrease with increasing distance down-coulee (away from the proposed mine area) because of the increasing importance of the contributing undisturbed ground water basin, and the diminishing influence of the pit drawdown discussed above. Whether such a decrease in total ground water flow would result in a cessation of all surface flow beyond the coulee heads is unknown. Present data do not allow a reliable estimate of the hydrologic impact to East Fork Sarpy Creek; however, it would probably be negligible because most spring discharge to the coulees is currently lost to evapotranspiration.

The beginning of this ground water impact would occur when initial mining disturbance approaches the ground water divide. Final disruption of the system and dewatering of the springs would probably occur within 5 to 10 years following mining.

The decrease in ground water flow through the two coulees tributary to the alluvium of East Fork Sarpy Creek would be partially compensated for by increased surface runoff from the post-mining land surface. (See Surface Water.) This would contribute water to the unmined coulees downgradient from the mine. This recharge would occur intermittently in response to spring snowmelt and occasional heavy rainfall runoff. Because even a doubling of runoff rates would provide only a small component of additional discharge from the basin, this phenomenon would have a negligible balancing effect.

Additional impacts on the ground water system would occur under the 5-year plan through the loss of 3 water wells. Wells which would be mined out under the 5-year plan are Nos. 274, 275, and 276. (See figure II-4.)

b. 20-year mine plan

Eventual approval of the 20-year mining plan would cause significantly more severe impacts on the East Fork Sarpy Creek ground water basin. The significance of these impacts is discussed in Land Use, Vegetation, and Wildlife. Because the 20-year mine plan area makes up 2.5 percent of the East Fork basin, and because of the same dewatering effect of the mine pit drawdown discussed under the 5-year plan, it is reasonable to assume that a measurable and significant interruption of ground water flow would occur to the East Fork basin. Such a disruption of the hydrologic system could well constitute a significant impact to any subirrigation along East Fork Sarpy Creek near or downstream from its confluence with the three tributary coulees, especially during drought years. This loss of ground water flow would probably result in a water table drop in the East Fork alluvium and a consequent loss of surface flow during normal low flow seasons.

In the Middle Fork Sarpy Creek basin, eventual mining under the 20-year mine plan would remove at least 2 springs in section 36, as well as their recharge area (figure II-1); however, the ground water loss to the alluvium of Middle Fork Sarpy Creek would not likely be measurable. The loss of these springs was discussed in a previous EIS (Montana Department of State Lands, 1977). Data are lacking to make a more definitive prediction of ground water impacts on Middle Fork Sarpy Creek.

Following reclamation, increased surface runoff from the reclaimed surface (see Surface Water) would contribute slightly to increased peak surface flows in East Fork Sarpy Creek, due to both spring snowmelt and storms. Such an occurrence would compensate slightly for decreased ground water flow, but the timing of these contributions will differ. Whereas ground water flow through the coulees is relatively constant throughout the growing season, surface flows in response to weather events vary greatly in magnitude and thus in utility during the growing season.

Post-mining ground water flow through the mine spoils would not reestablish springs initially destroyed by mining, nor does Westmoreland

propose to attempt to reestablish springs by other means. Ground water moving through the spoil would likely follow the gradient of the base of the mine pit--assumed to be the base of the Robinson coal. Ground water entering the spoil from unmined coal to the south would eventually reenter the undisturbed ground-water-bearing units to the north and east. The timing of this occurrence cannot be established with any reasonable degree of accuracy.

Although current data are limited, there is no evidence that post-mining mineralization of the ground water moving through spoils would measureably affect existing ground water quality beyond the mine site. Wells established in spoil after mining could potentially possess ground water of such inferior quality that it would be of marginal use for human or livestock consumption; however, the amount of water expected to saturate the base of the spoils after mining would be very slight. Good quality ground water exists at greater depth and would not likely be affected by the proposed mining.

Wells which would be mined out under the 20-year plan are 303 and 306; those which would probably be impacted by a lowered water level are: 64, 253, 257, 273, 299, 304, 314, 315, 316, 317, 318, 325, 327, 328, 332, 333, 334, 335, 336, 337 (figure II-4). Additional discussion of wells which would be impacted or mined out under the 20-year mine plan is contained in FES 77-17 (U.S. Department of the Interior, 1977).

C. CLIMATE

No significant impacts on the climate of the area are expected. Precipitation might increase slightly in the immediate vicinity of the mine due to fugitive dust forming condensation nuclei, but the increase would probably not be detectable. Electric power generation units, not strip mines, have the greatest potential for influencing climate in the northern Powder River basin. (See DES 79-41.)

D. AIR QUALITY

Air quality impacts would not be significant: existing enforcable standards would not be exceeded, and damage to vegetation or risk to human health would be limited. Controls proposed by the company or now in existence would keep emissions to less than those encountered at some other strip mines in the Powder River coal basin. However, particulate and gaseous emissions from the mine would be approximately twice current levels.

Potential particulate emissions would total about 4,000 tons/year at a production level of 10 mty; controls proposed by Westmoreland would limit actual particulate emissions to about 1920 tons/year. (See table III-1.) About 40 percent of the emissions would be coal dust, most of

TABLE III-1.--Estimated potential and controlled particulate emissions, Absaloka mine, 10 mty production level

[Source: U.S. Environmental Protection Agency, 1979]

Activity	Basic	Emission factor	Soil	Coal	Control strategy	Control (percent)	Soil	Coal
Topsoil removal-----	110 acres X 3 ft. depth	0.38 lb/yd^3	202,312	---	---	---	202,312	---
Overburden removal-----	2.5 yd^3/T X 10,000,000 T	.0056 lb/yd^3	140,000	---	---	---	140,000	---
Coal loading-----	10,000,000 T	0.12 lb/T	---	1,200,000	---	---	---	1,200,000
Overburden drilling----	80 holes/day X 260 days/yr	0.22 lb/hole	4,756	---	Water injection	90(?)	458	---
Coal drilling----	80 holes/day X 260 days/yr	1.50 lb/hole	---	31,200	Water injection	90(?)	---	3,120
Overburden blasting----	2 blasts/day X 260 days/yr	58.5 lb/blast	30,420	---	---	---	30,420	---
Coal blasting----	2 blasts/day X 260 days/yr	49.8 lb/blast	---	25,896	---	---	---	25,896
Haul roads-------	83,000 trips X 5 mi/trip (max)	6.8 lb/vmt	2,822,000	---	Water	50	1,411,000	---
Truck dump--------	10,000,000 T	.007 lb/T	---	70,000	---	---	---	70,000
Crushing:								
Primary-----	10,000,000 T	0.02 lb/T	---	200,000	Enclosed	99	---	2,000
Secondary---	10,000,000 T	0.06 lb/T	---	600,000	Enclosed	99	---	6,000
Conveyors-----	10,000,000 T	0.2 lb/T	---	2,000,000	Partial covers	90	---	200,000
Coal storage-----	1.6 acre 2.8 m/sec wind	1.6 u/acre/hr = wind speed	---	62,790	Enclosed storage	99	---	628
Train loading-----	10,000,000 T	0.0002 lb/T	---	2,000	Retractable chute	50(?)	---	1,000
Exposed areas-------	330 acre (est.)	1,200 lb/acre	396,000	---	---	---	396,000	---
Access road traffic-----	100 veh/day X 314 days/yr X 2 mi.	4.4 lb/vmt	276,320	---	Water	50	137,160	---
Totals-------------------------------------			3,871,628 = 1,936 T	4,191,886 = 2,095 T			2,337,350 = 1,169 T	1,508,644 = 754 T

Percent control--soil = 40 Total potential emissions = 4,031 T/yr Plant emissions: Total potential = 1,436 T/yr
Percent control--coal = 64 Total net emissions = 1,923 T/yr Net = 140 T/yr
Percent control--total emission = 52 Percent control = 90

which would come from the loading of coal onto haul trucks. About 60 percent of the particulate emissions would be from soil and overburden, primarily off of haul roads.

The particulate emissions would largely be emitted from within the mine pits and would tend to settle out on the pit walls. Continued use of front-end loaders, which have a shorter drop distance than conventional coal loading shovels, would tend to reduce particulate emissions, as would the continued practice of minimizing the drop distance from the overburden dragline. (See Air Quality, chapter II.)

Particulate emissions would probably exceed the National Ambient Air Quality Standards at the high volume sampler near the shop and loadout facilities; this sampler, however, is within the mine boundary and thus does not provide data valid for enforcement purposes.

Dustfall (a measure of settleable particulates) would probably not exceed the standard set for areas of heavy industry such as the Absaloka mine. Dustfall measurements within about 1/2 mile of the mine already exceed the standards set for residential areas (see Air Quality, chapter II); with the projected increase in production the excursions would presumably occur more often. Dustfall would exceed the proposed Montana ambient air quality standards less often than the current residential standard. The proposed standard is less stringent because it is based on a 30 day average instead of a 3 month average.

Any excursions over the particulate standards would be due to the combined emissions from the mine and from nearby dirt roads and agricultural operations. Coal dust from the mine, however, would have a higher potential of causing health problems and vegetation impacts than soil dust. People living near the mine would not likely suffer health effects from mine-related dust. Workers at the mine would be exposed to higher levels of dust, which could cause health problems under long-term exposure. A study of workers at eastern surface coal mines (Fairman and others, 1977) showed evidence of pneumoconiosis among 2.5 percent of those who had done little underground mining; their mean exposure to coal dust was 21 years. It is difficult to extrapolate this finding to the Absaloka mine, except to say the mine workers would be subject to some risk; a considerably lower risk, however, than that experienced by underground coal mine workers.

Gaseous emissions from the present mine equipment would probably show occasional violations of the proposed Montana hourly average (0.17 ppm) for nitrogen dioxide (NO_2), based on the amount of NO_2 that would be emitted by the mine equipment listed in table III-2. The NO_2 and the hydrocarbons react to form photochemical pollutants, which would occasionally form a brown haze over the area, reducing visibility. Such episodes would be fairly infrequent, because calm days are rare in the area. (See Climate, chapter II.)

Ambient air quality standards for sulfur dioxide would probably not be exceeded because presently available diesel fuels contain less than

TABLE III-2.--Estimated gaseous emissions from the Absaloka mine

[Source: U.S. Environmental Protection Agency, 1977. Data are in pounds.]

	Number of units	Hours of operation[1]	CO	HC	NO_x	SO_x	Particulate
Dozers-------------	14	1S,5D	21,518	6,818	147,056	10,136	4,805
Dozers-------------	2	3S,7D	12,948	4,100	88,476	6,096	2,891
Wheel tractors-----	3	1S,5D	13,416	924	6,203	562	849
Coal haulers-------	12	2S,5D	66,888	21,816	380,880	22,644	12,780
Front end loaders--	8	2S,5D	18,400	6,224	79,872	6,056	5,724
Graders------------	4	2S,5D	3,578	899	17,472	1,431	1,015
Water tankers------	3	2S,5D	16,722	5,454	95,220	5,661	3,195
Rear dump truck----	1	1S,5D*,26W	1,394	455	7,935	472	266
Truck cranes-------	6	1S,5D*,26W	8,361	2,727	47,610	2,830	1,598
200 T crane--------	1	1S,1D*	172	65	944	59	106
Scrapers-----------	14	1S,5D	42,518	18,228	18,132	13,482	11,823
John Deere tractor-	3	1S,5D,8W	114	55	319	30	44

[1]S = Shifts per day; D = Days per week.

*Maximum values, exact operation hours varies.

2 percent sulfur. The present oil shortage may force the using of diesel fuel containing 4-5 percent sulfur; under those circumstances the ambient standard could be exceeded. There is currently no monitoring for SO_2 or any other gaseous pollutant at the mine. Vegetation within the mine boundaries would probably show reduced photosynthesis, mechanical damage, or other injury through particulates coating leaf surfaces or from nitrogen dioxide (NO_2). Vegetation within about 1 mile of the mine boundary would probably be only slightly affected--perhaps too little to noticeably reduce vegetative productivity. Animals grazing on affected plants or inhaling pollutants could be harmed, although grazing would not ordinarily occur within 1/2 mile of the active mine pits. Very little research has been done on this question, however.

Impacts on air quality would be short-term, lasting a few days, or in the case of vegetation, until the next growing season. There would be a noticeable increase in particulates as the production level increases and the mining moves closer to the monitors. Particulate monitoring should be continued, and a continuous NO_2 monitor should probably be placed in the prevalent downwind direction.

Visibility would be affected within 1 mile or so of the mine, primarily by NO_2 and hydrocarbons which combine to form photochemical smog. Particulates would reduce local visibility on windy days. The persistence of NO_2, hydrocarbons, and their photochemical products is not extensively documented, but is believed to be several days.

E. SOILS

The impact of mining on soils under the 5-year mine plan would be moderately significant. The major impacts would be those which are unavoidable at any mine in the semiarid West; however, erosion aggravated by the proposed long straight slopes on the reclaimed land surface could be avoided. The reclaimed slopes would integrate poorly with the surrounding undisturbed landscape and would be especially susceptible to erosion because of the dominant surface texture of fine sandy loam. The resulting erosion would cause an accelerated loss of replaced topsoil and increase sedimentation, reducing vegetative productivity. This would continue until the slopes developed a relatively stable configuration, and would probably require decades to centuries. (See Geomorphology, chapter III.)

Generally unavoidable soil alterations include a slight to moderate reduction of infiltration and percolation rates, a temporary increase in nutrients available to plants, and a complete alteration of soil distribution patterns. These alterations in the soil's physical properties would increase the amount of runoff during high intensity storms which are common in the region. Erosion rates would be further aggravated by the proposed slopes which differ significantly from those presently on the site and in the region. (See Geomorphology.) Reduction of soil organic matter, surface crusting, and the loss of soil structure and pore continuity would all contribute to increased runoff and erosion. The implications of increased nutrient release are discussed in the ensuing Vegetation section.

The company has demonstrated that some of these impacts can be greatly reduced by direct haul and replacement of the "A" (surface) horizon on the reclaimed surface. Approximately 50 percent of the "A" horizon soil material in the area affected by the 5-year mine plan would be direct hauled to the reclamation surface. The remainder would be derived from existing soil stockpiles or first stored, then placed, as needed. Those areas where direct-hauled soil material is used would have less loss of organic matter and would have greater survival of plant propagules and seeds. As a result, vegetative diversity and establishment and infiltration rates would be enhanced, with less runoff and erosion. The company has indicated that direct haul of "A" horizon soil material will be increased if logistically possible. Mining patterns and seasonal weather conditions (spring rains, deep snow, etc.) often combine to make direct haul impractical or undesirable. Plant survival and reproduction appears to be greatest if soil is removed and replaced during periods of plant dormancy. (See Technical Alternatives, chapter VIII.)

The relationships between topsoil material and overburden are both chemical and physical. Chemically, the potential exists for contamination of topsoil by interburden spoils. The procedure used by the company to avoid this problem include preferential surface placement of more favorable

overburden spoils and sampling of the regraded spoils prior to topsoil placement. Analysis of randomly sampled topsoiled spoils (see table III-3) in June 1979 indicates that this approach has been successful. Box cut spoils, composed entirely of the more desirable overburden spoils were not analyzed, but were inspected in the field.

TABLE III-3.--Selected topsoiled spoil properties, Westmoreland Resources Absaloka mine

Sample	1	2	3	4	5	State suspect level
pH-------	6.9	7.5	7.2	7.4	7.6	>8.8
EC[1]------	4.5	3.4	3.5	5.2	1.8	4-6
SAR[2]-----	1.3	3.0	1.1	3.9	0.7	12
Clay[3]----	28	34	24	34	24	40
Silt[3]----	36	38	28	42	42	---
Sand[3]----	36	28	48	24	34	---

[1]Electrical Conductivity--a measure of soil salinity.
[2]Sodium Adsorption Ratio--A measure of soil sodicity.
[3]Data are in percent.

None of the tested parameters exceeded State suspect levels. (See Overburden, chapter II.) EC values between 4 and 6 would not be generally acceptable in topsoil materials, but may be in regraded spoils. However, there does appear to be a correlation between rill and gully erosion in the topsoil, and percent clay in the spoil material. Although the amount of clay does not exceed State suspect levels (40 percent), it is high enough to inhibit percolation and increase runoff and erosion. Based on geomorphic principles and field observations at the Absaloka mine, well designed slope configuration can minimize erosion rates and substantially mitigate the existing adverse soil and spoil characteristics. There are important relationships between and among topsoil, spoils, and slope parameters which cannot be quantified based on present knowledge. It is apparent that complex slopes which are basically convex-concave (flattened S-shape) have a much lower erosion rate than the straight or convex slopes which are commonly found on reclamation surfaces. (See Geomorphology.)

Little can be said concerning the soil impacts of the remainder of the 20-year mine plan. No reclamation plan has been submitted for that area. There are a number of coulee soils which would probably be lost in both form and function because the drainages on the reclamation surface would not be spring fed, and the adjacent slopes would be sharply reduced. Unavoidable impacts would be the same as those for the 5-year mine plan.

F. VEGETATION

Impacts on vegetation may be relatively significant, because vegetation in the coulees northeast of the mine could be greatly reduced due to reduction in water supply. The exact extent of the impacts would depend upon the reaction of the hydrologic regime to mining and the resultant effect on vegetation. The following represents a worst case analysis; however, the magnitude and significance of impacts would be somewhat less should the dewatering of the coulees be less than 100 percent. The loss of the existing vegetative communities and the water availability in those coulees would reduce wildlife and livestock carrying capacity over a larger area. (See Wildlife and Land Use.) This impact would begin to occur under the 5-year mining plan and would be much more extensive under the 20-year mine plan; it could not be avoided except by mining a different area within Tract III. The offsite loss of vegetative productivity and diversity is not typical of other strip mines in Montana, which to date have not disturbed areas of similar diverse and productive vegetation.

There are no known threatened or endangered species in or near the proposed mine area, so no impacts on these species are expected.

Mining would result in the incremental destruction of existing vegetation on about 360 acres in the Tract III area during the 5-year permit period and on about 2,900 acres, including previous disturbances, by the end of the 20-year mine plan. About 22 additional acres of existing vegetation would be eliminated by the relocation of the county road. Offsite impacts to about 50 to 60 acres of drainage-bottom vegetation are anticipated, owing to the disturbance of the hydrologic regime. (See Hydrology.) Although reclamation would establish a vegetation cover on the mined lands, the long-term effect of mining would be the loss of a complex vegetation mosaic and a reduced species diversity and potential productivity. Impacts on vegetation would therefore be relatively significant. Potential vegetative productivity would be reduced on the order of 10 to 20 percent below current potential productivity under optimal management.

Existing vegetation would be destroyed at a rate of about 11 acres for each 1 million tons of coal to be mined--about 110 acres per year at the anticipated mining rate of 10 million tons of coal/year (table I-3). Many of the premining plant communities, their distributions, and their species diversity would not be established in the short-term, owing to the substantial alteration of the premining environmental characteristics responsible for the communities' development and maintenance, and the seeding mix used in reclamation.

Under the 5-year plan, mining would impact some ponderosa pine, skunkbush, and riparian plant communities which are, at best, difficult to reclaim. Relatively substantial offsite impacts, stemming from the disturbance of the existing hydrologic regime (see Hydrology, chapter

III) would be imposed on the phreatophytic (plants with long roots reaching to the water table) and wetland vegetation in the upper reaches of the drainages north of the mine area. The reduction of surface and ground water would likely cause a corresponding reduction in the vitality (reproductive success) and vigor (relative size and health) of the communities. This would likely cause a successional trend toward plant species which tolerate dryer conditions. Because reclamation technology has not demonstrated an ability to reestablish hydrologic functions similar to those present, the reclamation of the mine area would not alleviate the impacts on this vegetation. Existing agricultural plant communities would not be reclaimed because Westmoreland has not applied for alternative reclamation (82-4-332(7) MCA).

Impacts under the 20-year mine plan would be more extensive than under the 5-year plan. A greater amount of drainage-bottom vegetation and ponderosa pine, all of which is difficult to reclaim, would be disturbed. The drainage-bottom vegetation in the upper reaches of the drainages north of the 5-year permit area would be destroyed. Offsite hydrologic impacts on vegetation would extend further down these drainages and in the drainages east of the 20-year mine plan area. (See Hydrology.)

The relocation of the county road would eliminate an additional 22 acres of existing vegetation of which about one-half would be in ponderosa pine communities. At the end of 10 years of mining the county road would again have to be moved, causing additional impacts on vegetation. No specific information has been supplied regarding the disposition of the road upon the completion of mining; therefore, the impacts are considered to be permanent.

Long-term reclamation success depends on complex interactions of environmental factors, including surface stability, hydrologic regimes, soils, vegetation succession, and land management. Successful short-term vegetation establishment, therefore, does not necessarily presage long-term success. Data from Westmoreland suggest that reclamation would initially establish a vegetation cover which, relative to the premining communities, would be low in species diversity. Within the first few years following vegetation establishment, species diversity would decline further as perennial grass species (primarily a few cool-season grasses favored in reclamation seed mixes) became dominant and crowd out less competitive species (Montana Agricultural Experiment Station, 1978). This would tend to reduce livestock carrying capacity. (See Land Use.) Microsites resulting from the engineered topographic diversity would have only minor influences on species distribution during the early stages of reclamation; however, these microsites would exert considerably more influence on differential species establishment and distribution in later successional stages.

Substrate modification techniques and the direct haul of selected topsoils (described under Mitigating Measures in chapter I), in conjunction with the transplanting of trees and shrubs, would increase the species diversity and increase the likelihood of at least short-term

establishment of selected species. Westmoreland has had some initial success (2 years) in establishing ponderosa pine on reclaimed areas; however, this establishment does not ensure long-term success as self-sustaining populations (Campbell, 1975). Should the success of transplantings be only short term, several species of trees and shrubs would be lost as self-sustaining populations for the long term.

Initial productivity of reseeded areas would be high, owing to the high nutrient availability resulting from the physical disturbance of soils, and to fertilization. Within the first 4 to 6 years, plant litter would accumulate, tying up nutrients such as nitrogen and phosphorus in an unavailable form. Productivity would then decline and the vegetation cover would open up, allowing a slow invasion of species from adjacent undisturbed areas (Montana Agricultural Experient Station, 1978), thus increasing species diversity. As the plant litter decomposed, nutrients would gradually return to the soil. During this time, established vegetation would be more susceptible to environmental extremes (e.g., drought) because of the narrow ecologic tolerances of the floristically depauperate (less diverse) vegetation. Several decades later when currently projected mining ends, incipient vegetation patterns would likely be recognizable in the earliest reclaimed areas. Eventually, these patterns would evolve into a more desirable distribution of vegetation.

Vegetation adjacent to the mine area, as well as vegetation established on reclamation areas, would be subjected to a variety of secondary impacts, the most serious of which would likely result from fugitive dust. Dust from mining, county road relocations, and other activities would impact vegetation to an unknown degree. Only in areas of extremely high dust deposition (mostly limited to within about 1 mile of the mine) would the physical accumulation of dust on leaves or the absorption of trace elements noticeably change plant metabolism and plant community structure. The presence of coal dust on soil surfaces may alter the local microclimate and thus affect the vegetation. Susceptibility to fungal infection due to dust deposition may increase (Manning, 1971; Shonbeck, 1960), thus reducing the nutritional value of the forage.

G. WILDLIFE

Impacts on wildlife under the proposed 5-year and 20-year mine plans are anticipated to be relatively significant, owing to the destruction and deterioration of vegetation which presently supports a high diversity of wildlife species. A reduction of the floral diversity and an elimination of the vegetation mosaic would reduce the carrying capacity of the mine area for many species. The reduction in carrying capacity would result from the loss of contrasting vegetation types which presently satisfy the alternating (seasonal) needs of the more mobile species and from the failure to reestablish specific habitat characteristics upon which some less mobile species depend. Off-site hydrologic impacts would affect water availability and vegetation, thus inflicting additional impacts on

wildlife species which use the springs and riparian vegetation north and east of the mine area. These impacts could not be mitigated except by mining a different part of Tract III. The county road relocation would also harm wildlife habitat and would result in the short-term interference of established migration routes and the disturbance of what is now relatively secure habitat.

Two endangered species, the peregrine falcon and the bald eagle, have been observed in the Tract III area--one sighting of a peregrine falcon within the proposed 5-year mine area. If impacts do occur to these species, the impacts would likely be very minimal since the birds only use the area occasionally during migrations.

Under the proposed 5-year plan, the most significant impacts on wildlife would result from the loss of springs in the coulee bottoms north of the mine area (see Hydrology) and the deterioration of riparian vegetation in this area. (See Vegetation.) Such disturbances would result in the loss of some species (primarily amphibians) and would cause other species (turkeys, mule deer, white-tailed deer, and several song birds) to shift their distributions to other areas which would satisfy the needs presently fulfilled by the prevailing conditions. Such other areas are likely already occupied; therefore, the overall carrying capacity of the area would probably be reduced. (See Appendix C.) The destruction of 360 acres of vegetation within the 5-year mine area, except for the loss of 1 spring and about 16 acres of ponderosa pine, would be relatively insignificant because the habitat types to be destroyed comprise grassland and agricultural lands--the easiest of the habitat types to reclaim.

The proposed 20-year plan would disturb a considerably greater area --2,900 acres, all of which is presently used by wildlife. Much of the area is composed of habitat types (ponderosa pine, riparian, and skunk-bush) which currently support more diverse wildlife populations; to date, these habitat types have not been successfully reclaimed at any of the strip mines in Montana. (See Vegetation.) The ponderosa pine breaks and coulee bottoms north of the mine area are relatively secure habitats and serve as major migration routes for mule deer, white-tailed deer, and turkeys. It is doubtful that present-day reclamation technologies could reestablish these habitat types to suitable levels within the next several decades to perhaps a century, if at all. Further, the destruction of ponderosa pine and riparian habitats would adversely affect nesting and perching sites for great horned owls, red-tailed hawks, Swainson's hawks, and other birds of prey. Several species of song birds such as warblers, mourning doves, and woodpeckers would similarly be affected by the loss of these habitats. Until such time as these habitats are reclaimed, it is unlikely that any of these species would make extensive use of the reclamation areas.

Westmoreland's wildlife monitoring data (Westmoreland Resources, Inc., 1978) reveals some use of reclamation areas by mule deer, white-tailed

deer, turkeys, and sharp-tailed grouse. This is not unexpected because the existing reclaimed areas are in close proximity to undisturbed areas, and these animals typically make use of a number of habitats. It is not known, however, if current levels of use would be sustained throughout the 2,900 acre mine area at the end of mining. It is more likely that wildlife use would decrease as the distance from the undisturbed perimeter increased and the proximity to diverse habitats decreased. Thus, an overall reduction in the carrying capacity of the entire reclaimed area could be expected. Mining at this scale has not taken place in the northern Powder River basin long enough to accurately predict the long-term effect of mining on wildlife.

Several species of wildlife, including ring-necked pheasants, waterfowl, and many of the small mammals would likely not be significantly impacted. There is a possibility, however slight, that the fishery in lower Sarpy Creek could be impacted by an increase in the sediment load which may arise as a result of mining and reclamation.

The county road relocation would disturb about 22 acres of wildlife habitat. It would also result in increased human access to an area of relatively secure habitat for mule deer, white-tailed deer, and turkeys that is currently inaccessible by vehicle. This would increase harassment and/or the legal and illegal killing of game. This impact would be overshadowed as mining under the 20-year plan destroys the ponderosa pine and riparian vegetation south and west of the relocated road. The coulee bottoms crossed by the road relocation serve as migration routes for these species and the disturbance would induce some alteration in behavior. This impact would be of short duration and of relatively minor significance owing to the proposed mining sequence.

H. SOCIOLOGY

Impacts on the local society would not be significant. The rates and types of growth expected as a result of the proposed mine expansion would not be so rapid or so severe to be highly disruptive. Impacts generally would be less than in rapid-growth energy boomtowns such as Colstrip and Forsyth in the early 1970's. However, ranchers near the mine and people in Hardin would be subjected to additional pollution and stress, the pace of life would generally increase in Hardin, and the potential for conflicts between and among the white and Indian cultures would increase.

Dust, noise, and the generally increased stress of life could potentially cause higher incidence of mental and physical health problems, although the probability of such problems is not known. Mine workers, ranchers, and people in Hardin would be most affected.

1. Population Growth

The Westmoreland mine would cause population in Big Horn County and Hardin to grow slightly faster between 1980 and 2000 than it would in the

absence of the mine. Neither Hardin nor Big Horn County would approach rapid "boomtown" growth conditions. The population of neighboring counties and towns would not be noticeably affected by the mine.

Big Horn County would grow at an average rate of 1.8 percent per year--from an estimated 1980 population of 10,600 to a projected population of about 15,000 by the year 2000. (See figure III-1.) The Westmoreland mine would contribute a little more than one-fourth of the county's growth, with most of the growth due to projected new mining in the southern part of the county and to natural increases among the Crow Indians. Annual growth rates would peak at slightly over 2 percent from 1995 to 2000, and would be lowest in 1981 at 0.7 percent, indicating that there would be no rapid fluctuations in population over the foreseeable future.

Nearly all of Big Horn County's growth that would be attributable to the Westmoreland mine would occur in Hardin. Hardin would grow from an estimated 1980 population of 3,200 to about 7,600 by the year 2,000. Annual growth rates would vary from a low of 2.3 percent in 1981 to a high of 6 percent in 1988. Hardin's growth would primarily be the result of increases in ancillary employment due to the mine, not to the mine workers themselves. (See Economics.) The Westmoreland mine would contribute about one-fourth of the total growth in Hardin.

Growth rates in both Hardin and Big Horn County would be within the range considered "moderate" by Gilmore and Duff (1975), meaning that with adequate planning, community and social services would not be unduly strained, and no breakdown in the local society would be expected as a result of the rate of growth.

If past hiring practices at the mine continue, it is expected that about half of the workers at the mine would be local residents (Crow and non-Indian); thus, the mine would not contribute large numbers of new mine workers to the local population. Much of the growth in Hardin would be in the form of newcomers, however, who would be attracted to the new ancillary employment opportunities.

2. Population Characteristics

Most of the new people that would come into Hardin would be white. This would reverse the existing trend of declining white population in Big Horn County. The population of Crow Indians and whites would not equalize as they probably would without further coal mining in the county. (See FES 77-17, U.S. Department of the Interior, 1977.)

The new workers at the mine would have a higher-than-average ratio of males to females. Many of these workers would be locally recruited, so there would not be a large influx of single males into Hardin. Most of the population increase in Hardin would be due to new ancillary employment. These people would presumably have more nearly equal numbers of males and females, and thus would tend to moderate Hardin's lower-than-average proportion of males to females. This would tend to slightly

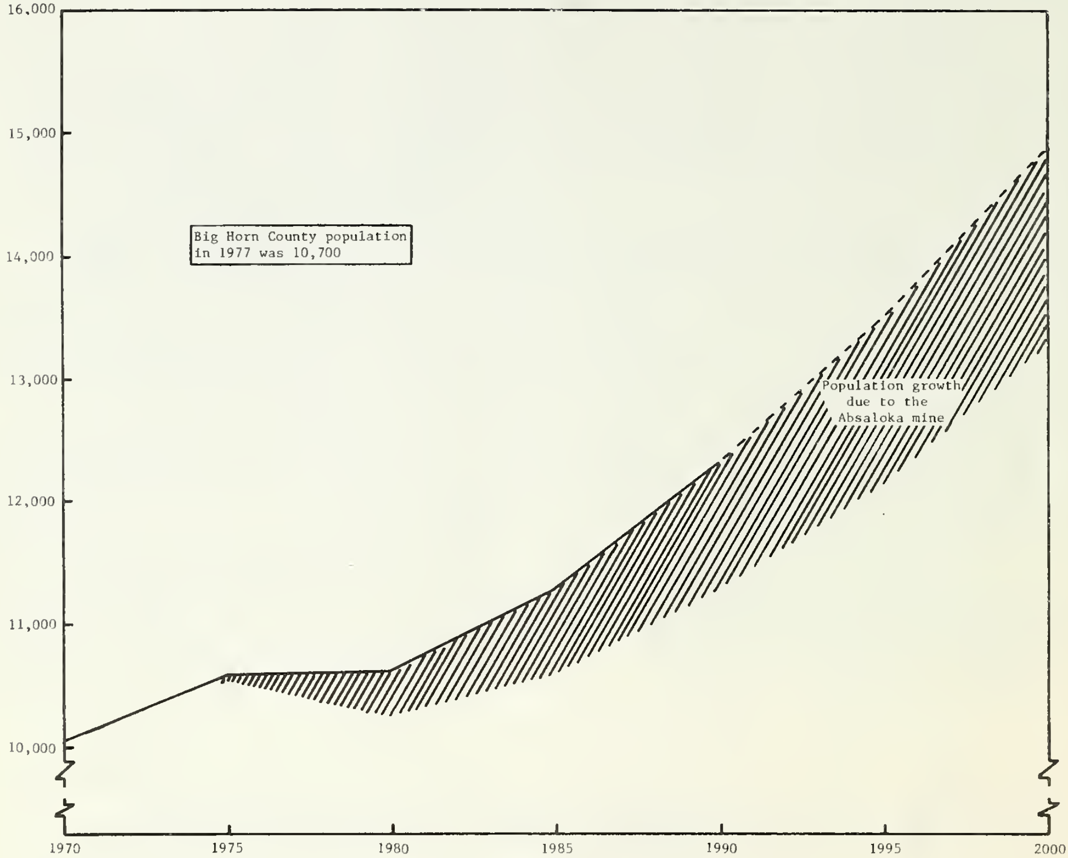

FIGURE III-1.--Population growth in Big Horn County due to the Absaloka mine. Dashed curve after 1990 indicates less reliable projection.

increase the pace of life in Hardin, but not nearly as much as would be expected in rural boomtowns where large numbers of single males move into a community.

The sex ratios among the Crow population would be affected in the same way--as more of the Crow benefit economically from the mine, changes in their economic and social status would tend to promote a more nearly equal proportion of males to females.

3. Social Environment

a. Hardin

The new people expected to move to Big Horn County and particularly Hardin would increase the diversity of local society. Many of the newcomers would move to the area in response to economic opportunities (both at the mine and in ancillary businesses); these people would have different interests on the whole than the long-time residents who are more closely tied to the agricultural economy. The influx of newcomers would add a source of social change to the area which would require accomodation of all groups to the new social conditions. The newcomers would spur demands for new social clubs, civic organizations, churches, and other cultural activities. The newcomers would presumably desire new and additional recreational facilities, although they would likely travel to Billings to meet some of these needs.

The increased diversity of life in Hardin would be achieved at a cost of many amenities of life in a rural community. For example, people would find it more necessary to lock their doors; the dependence on neighbors for company and mutual assistance would decrease; traffic and noise would increase; long time residents would notice more stangers and would know fewer of the townspeople by name. Recreation areas in and around Hardin would become more crowded. Many of the newcomers would have difficulty finding housing, due to the limitations of the sewage disposal system stressed by population growth. (See Community Services.) These changes are a cost of growth in any rural community, regardless of source; the Westmoreland mine would contribute a major share of that growth in the Hardin mining area.

Social impacts in Hardin would be less serious than in Forsyth or Colstrip, because the growth rates in Hardin would be less, and because the industrial developments affecting Hardin would be about 30 miles to the east instead of adjacent to the town as they are in Colstrip. Because the growth rates in Hardin would be lower, and because about half of the mine workers would be local residents, there would be fewer people to assimilate into the local society than in Forsyth in the early 1970's. As a result, the social system in Hardin would not be as severely strained as in a boomtown, but would nonetheless change in response to the assimilation of newcomers.

b. Ranchers

The ranchers living close to Tract III, especially on the east side of the tract, would experience increased impacts of the kind already occurring. (See Sociology, chapter II.) As the mine moves to the east, the sources of fugitive dust, noise, and blasting would be closer to ranch houses. Blasting has reportedly caused some structural damage to a few ranch buildings near the mine. This damage can be expected to increase and perhaps extend to additional buildings. The noise from the blasts can be heard for several miles, and is rather annoying to area ranchers, as is the fugitive dust from the mine (Toole, 1976).

Most of the ranchers in the area can be expected to oppose the mine (Mountain West, 1975; Montana Department of State Lands, 1977). Although the source of the occasional vandalism at and near the mine is unknown, such incidents would probably continue, and would increase antagonism between the ranchers and the mine operators.

Traffic along FAS 384 and nearby back roads would increase (see Transportation), hindering movement of equipment and cattle. With more people in the vicinity of the mine, poaching of wildlife would likely increase, and cattle rustling could become a problem as it has in the Colstrip area.

The rural-agricultural society in the Sarpy Creek area would change due to the mine. Several families have left the area in reaction to the mine, and more families may leave as the mine expands. This would change social relationships and patterns of neighboring. The local ranchers are unhappy at the loss of these neighbors, and if more people leave, they would feel a further loss.

A number of springs and seeps would be destroyed or their flow reduced from mining. (See Hydrology.) This hydrologic disturbance would interfere with ranching operations (see Land Use) and would subject the ranchers to further stress.

c. Indians

Impacts on the Crow Indian population of Big Horn County are difficult to predict because data are lacking. The increased Crow employment at the mine would allow some of the Crow to better their economic and social position in terms of values held by the white culture. At the same time, the mine would increase conflicts between the white and Indian cultures, and potentially, within the Crow culture itself.

Increased royalties would allow the Crow to expand their program of buying out inholdings within the Reservation, and would also aid other Tribal programs. Indians who are now or are close to being economically secure would benefit from increased royalty distributions, and would be able to enhance their economic (and possibly social) position. On the other hand, more marginal or impoverished Indians would probably not

benefit, because the royalty distributions would only displace welfare payments. (See Economics.) Of course, reducing the welfare rolls would be an advantage, but poverty-level Indians could reasonably be expected to spend their royalty payments rapidly in order to preserve their welfare payments.

As more of the Crow benefit from the mine, a considerable number would remain unaffected, thus increasing the disparity between those who benefit and those who do not. This may lead to tensions and stress between those groups.

The potential exists for changes in the Crow family structure as a result of increased wealth and status of the Crow mine workers and others whose economic and social position improved. These people might possibly have smaller families, which over a generation or more could change the social organization of the Tribe in unknown ways.

The potential for conflict between the white and Indian cultures would also increase, in the form of possible jealousy over new Crow wealth, conflicts over use of Indian land for recreation, and increased whiteIndian interaction which could lead to animosity. The first conflict would be a direct result of royalty payments from the mine. The latter conflicts would come from the projected influx of predominantly white mine workers and ancillary employees.

I. ECONOMICS

The Absaloka mine expansion would not have a significant adverse economic impact. Hardin's tax base would not increase as fast as the need for new services, but this would only be partly due to the population increases caused by mining: the problem is typical of towns of rural Montana. The long term reduction in livestock grazing potential after mining would be minor--about $15,000 in annual gross income to livestock producers in Tract III. No significant fiscal problems for local school districts or Big Horn County are anticipated, because the mine is part of the school districts' and the county's tax base. By 1984, royalty payments to the Crow Tribe would dramatically increase the average Tribal member's income, assuming no change in the royalty's present disposition.

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1. Employment and Income

By 1985 the Absaloka mine would have created a total of 573 jobs in Big Horn County (see figure III-2). Of these, 263 would be in the ancillary

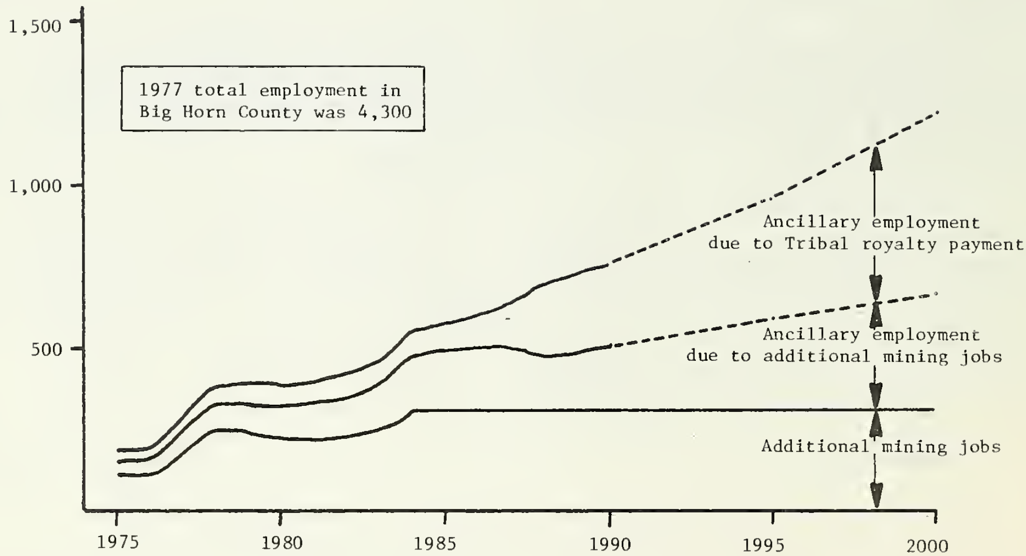

FIGURE III-2.--Additional employment due to the Absaloka mine, 1975-2000. Dashed lines show less certain projections.

sector[1] and 310 would be in the economic base sector. About 315 of these jobs have already been created, thus the approval of the proposed expansion would cause a total employment increase of 258 jobs. The mine payroll would continue to cause about two-thirds of the ancillary development; the royalty payment would provide the remainder.

After 1985, the royalty payment would become more important as a source of ancillary jobs. In 1988, after the coal in State section 36 has been mined and all 10 mty are produced from Crow-owned coal, the royalty payment to the Crow would become larger than the mine payroll. In the late 1990's, after the original 77 million tons of 6-percent royalty coal have been produced, the royalty payment would be responsible for at least two-thirds of the ancillary development. If the royalty rate is negotiated higher in 1984[2] and 1994, as appears likely, or if the FOB mine price increases faster than the average wage rate, then the royalty payment will eclipse the mine payroll sooner.

Although the mine payroll would be large from 1985 to 2000, the royalty payment would be the more significant. By 1990, at today's prices and royalty rates, the Crow Tribe would receive more than $7.25 million annually. If the Tribe continues to distribute 60 percent of the royalty as a per-capita payment, and if the current population trend remains unchanged, each tribal member household would receive more than $3,300/year. This large a per-capita payment would substantially increase the average Crow household income, which was $3,165 in 1977. This may lead to a significant change in the consumption patterns and hence the growth rate of the trade and service sector in the county.

Crow Tribal members who receive assistance payments would benefit to a much lesser degree. About 5 percent of the Tribal members now receive Aid to Families with Dependent Children (AFDC) benefits; their grants would be reduced by the amount of the per-capita payments received. A somewhat larger number of Tribal members receive food stamps; their bonus would be reduced by about 30 percent of the amount of the per-capita

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[1]Ancillary employment was projected using the COALTOWN computer simulation model developed at Montana State University. In addition to the usual increases in economic base employment provided by jobs at the Absaloka mine, an employment equivalent resulting from the royalty payment was included. The royalty equivalent was estimated by dividing projected royalty payments by the estimated average annual take-home pay. Because the royalty rates used were held constant at 6 and 8 percent over the entire 1979-2000 period, and the FOB mine price was assumed to increase no faster than the average wage rate at the mine, the royalty employment equivalent and hence the projected ancillary employment increase should be considered a lower limit.

[2]It is possible that the lease will come up for renegotiation in 1982; however, it is assumed here that the terms of the lease remain constant through the year 2000.

payments, or they would be disqualified from the food stamp program if their per-capita payment raised their total income above the limit.

2. Taxation

Westmoreland would provide, directly and indirectly, about one-fourth of the State tax revenues received from Big Horn County. The State would receive substantial revenues from the severance tax, the corporate license fee, individual income taxes, and mineral royalties on coal from the State section. The largest portion of these tax revenues would come from the severance tax.

From 1980-85, Westmoreland would pay about $85 million in severance taxes at current prices. Westmoreland's share of total State severance tax collections (estimated to be over $500 million based on projected production during the period) would be about the same as at present. The State would also receive 17.5 cents/ton from the 21.3 million tons mined from State section 36 during the period--about $3.7 million.

Although the income received by Tribal members who work at the mine would be subject to Montana tax, the portion of the royalty payment passed through to Tribal members would not be subject to tax.

Big Horn County's fiscal position, on the whole, would improve if the proposed mine expansion were approved. The benefits would come principally from the additional taxable value provided by the gross proceeds value of the coal production. The Absaloka mine would provide about 40 percent of the increases to the county's taxable value over the next 5 years.

Big Horn County is currently receiving 1.5 percent of the severance tax collected from the mining companies in the county. The county will receive this revenue only until December 31, 1979. (See table II-11.) The projected increases in taxable value would not be sufficient to replace this lost revenue without an increase in the tax rate.

Big Horn County now depends on coal mining for about two-thirds of its taxable value. Additional mining would increase the concentration of the taxable value, and thus make the county's tax base subject to increasing risk of fluctuation due to changes in coal production (from weather or other forces beyond the county's control). This risk of fluctuation would, in turn, increase the interest that investors will demand (and, in fact, receive) for purchasing general obligation bond issues of the county. The increased interest rate would make it relatively more difficult to finance needed improvements to the county's social capital. (See Community Services.)

As long as there were no interruptions in coal production, the two school districts in which the Absaloka mine pays taxes (Elementary District 17-H and High School District 1) would find it easier to finance their operations with the proposed mine expansion.

By 1985, the proposed mine expansion would increase school enrollments in the elementary and high school districts by about 180 students--about 11 percent more than current enrollment. The tax base would increase 4 to 5 times faster than enrollment during this period; thus, the mill levy would decline. The mill levy would still be higher than in the district which includes the Decker, Spring Creek, and proposed Pearl mines; that district is near the statutory minimum tax rate because it has relatively few students in it. In contrast, nearly 70 percent of the students in Big Horn County attend the districts in which the Absaloka mine pays taxes.

The City of Hardin's per-capita revenue (in constant dollars) would steadily decline, partly because of population growth associated with the mine. The decline would be to a level 5 to 10 percent below what would have been the case had there been no Absaloka mine. This is typically the case in surface mine development in southeastern Montana. The city's tax base does not include the mine, but its service area includes the miners, the additional ancillary employees, and their families.

The City of Hardin would have to decide which services it would cut back or not provide. The necessary new services (see Community Services) would be very difficult, if not impossible, to fund with local tax revenue, so the city would have to depend on outside assistance.

J. COMMUNITY SERVICES

Community services in Big Horn County and the town of Hardin would not be significantly strained. The greatest problem would be the financing of an additional primary school. Social services, in particular mental health, drug abuse, and welfare, would lag behind demand. In general, impacts would not be as severe as those experienced in many rural western boomtowns.

The following discussion of community service needs is based on projections by McQuiston (1979). The projections are carried only until 1990 due to the difficulty of accurately predicting population growth beyond that date.

Hardin's high school has the capacity to absorb the projected 15 percent increase in enrollment with the addition of about four teachers. Hardin's primary schools do not have the capacity to absorb the projected 15 percent increase, and another school would be necessary. Because of the lack of State participation in funding capital outlay needs, it would be difficult to provide the necessary facilities, and the district would probably depend on outside assistance, such as a grant from the Coal Board. Previous coal development, due mostly to the Westmoreland mine, has increased the Hardin district mill levy to a high level. The community is not expected to approve additional local funds to finance continued impact.

The high teacher turnover rate, and an expected shortage of 10-15 teachers for the primary and secondary schools would make recruitment and replacement of teachers difficult. Busing costs are expected to decrease on a per-student basis.

All social services in Big Horn County would need to be increased in proportion to population increases. Impacts would be greatest on protective services and, secondly, food stamps. Because there would not be a large influx of new temporary workers, problems such as juvenile delinquency associated with boomtowns are not expected. Welfare services listed as inadequate at present (see Community Services, chapter II) would be in still greater demand. Recent revisions in the welfare laws may cause a further increase in the number of people on food stamps.

The new sewage system planned for completion by 1980 will provide adequate sewage disposal for both new and existing housing through 1990. Increases in population would be adequately served once the new system is available. The number of mobile homes would increase about one-fourth from 1979-90, compared to an increase of only 1 percent or so in the number of houses.

Fire protection is expected to be adequate through 1990 without major additions or improvements. The county sheriff would need several additional deputies and 1 or 2 more patrol vehicles. No unusual problems are expected other than the normal increases in crime that accompany growth. Hardin's hospital would need to add as many as 10 new beds and several physicians.

K. LAND USE

Impacts on land use would be locally significant under the 20-year mine plan, because the number of livestock and wildlife that could potentially use the reclaimed land surface would be substantially less than at present. Impacts under the 5-year mine plan would be of relatively minor significance, because fewer springs and areas of high vegetative diversity and productivity would be disturbed. From a regional perspective, however, impacts even under the 20-year plan would not be significant: agricultural or wildlife production from the entire Sarpy Creek drainage basin would not be appreciably reduced, and the lands to be mined are not unique within southeastern Montana.

The 361 acres disturbed under the 5-year mine plan area would be reclaimed to rangeland and wildlife habitat. Livestock grazing would probably not begin until shortly after bond release. (See table III-4.) All other agricultural uses of the mine area would not be feasible until after final release of the bonding for the entire Tract III lease area, when future surface owners could put parts of the reclaimed area into other uses.

TABLE III-4.--Land use in Tract III and State section 36

[Data are in acres]

	Premining January 1972	Existing January 1979	Projected 1985	Projected 1998
Undisturbed-----------				
Crops---------------	1,662			
Ponderosa pine------	3,385			
Rangeland*----------	8,800			
Other---------------	1,539			
Subtotal----------	15,386	14,559.4	13,919.2	12,541.2
Disturbed:				
Active mining-------	0	582.8	569.0	569.0
Facilities and construction------	0	106.0	106.0	106.0
Associated----------	0	33.1	21.0	21.0
Reclamation---------	0	2.8	666.1	666.1
Other---------------	0	101.9	101.9	101.9
Subtotal----------	0	826.6	1,464	1,464
Bonds released				
Crops---------------	0	0	0	0
Ponderosa pine------	0	0	0	0
Rangeland*----------	0	0	2.8	1,380.5
Other---------------	0	0	0	0
Subtotal----------	0	0	2.8	1,380.5
Total-----------	15,386	15,386	15,386	15,386

* Includes some open stands of ponderosa pine.

For a variety of reasons (see Soils, Vegetation, and Hydrology), the post-mining surface would be essentially a modified cool-season pasture suitable for grazing in the spring and early summer. Grazing potential would be lower than the potential before mining because of decreased quality of forage; increased distance stock would have to go for water, loss of shade vegetation increasing stock water need; and increased susceptibility of surface to overgrazing because of loss of soil structure. Stock and wildlife would have to travel to the springs in the coulees more than 1/4 mile downslope to the east from the 5-year mine plan boundary. If the remainder of the 20-year plan took place as planned, those springs would also be lost and the animals would have to go at least 1 mile for water. Developed springs and wells, which are not currently proposed, would have to be established and maintained. Production costs on the postmine surface would also be higher because of the need for more extensive management, stock control, and the increased distance to water.

On net, the postmining land surface would become more typical of other rangeland in the Powder River Basin, a loss of up to 44 percent (Montana Department of State Lands, 1977) of its potential. If the surface owners following bond release do not establish hay fields, the cattle that graze on Tract III would become more dependent upon nearby hay producers for winter feed.

The improvements to the area transportation system (see Transportation, chapter II) would probably increase the population density along FAS 384. (See figure II-11.) The improved access would also open up the area to increased recreational pressure, trespass potential, and vandalism of unused remote structures.

By 1985, the increases in urban population, principally in Hardin, would also require some small amount of additional land--say 35-50 acres--for residential and commercial use. By 2000 the amount of land needed would be about 105-140 acres.

L. TRANSPORTATION

Impacts on road and rail transportation systems would not be significant. The projected increase in traffic would be well within the capacities of the road and rail segments most affected. Traffic on Big Horn County Road No. 55 and FAS 384 to Hardin would increase noticeably, producing additional dust and noise, but improvements to FAS 384 now underway would prevent any major congestion. Coal train traffic along the spur from the mine and along the mainline to the east would not approach or exceed the capacities of those segments.

Traffic impacts on FAS 384 from Spring Creek junction to Hardin would be minimal. By 1984, the number of cars and trucks using this road would increase 28 percent over the current level--from 250 vehicles/day to about 320 vehicles/day. Traffic would remain near this level through the remainder of the 20 year mine plan. At no time would the theoretical capacity of FAS 384 be exceeded, although traffic to and from the mine would compete with agricultural equipment and other local users. With the paving of this road from Hardin to County Road No. 55 (projected for completion in 1979), mining traffic would encounter little congestion, and traffic movement during shift changes would be relatively easy.

The proposed 5-year mine plan would mine through the area in which County Road No. 55 currently exists. Under the relocation plan approved and will be approximately 1/2 mile longer than the existing road. The current 20-year mine plan would necessitate relocation of the road again in 10 years to avoid mining.

The approved road relocation will create both positive and negative impacts. Snow will drift less on the relocated road than on the existing ridgetop route, because the new road will be moved northward down into

the coulees in an area protected from blowing snow. The new road will be equipped with modern livestock fencing and cattle guards--an improvement over the existing road (Ed Miller, Big Horn County official, oral commun.). The relocated road will be slightly longer to travel. Impacts on wildlife and vegetation in the area of the new road are discussed in their respective sections. Relocation costs will be borne by the coal consumer--a slight although long term impact, because the road would have to be relocated for both the 5- and 20-year mine plans.

Unit coal train traffic on the Sarpy Creek spur would increase from a current level of 20 trains/week to 38 trains/week--a 53 percent increase. At this level of mining, rail track capacity would not be exceeded; however, impacts such as increased noise, blowing fugitive coal dust, diesel emissions, and rail crossing hazards would occur. These impacts are discussed in DES 79-41 (Montana Department of State Lands and U.S. Department of the Interior, 1979) for a level of coal production somewhat higher than that now projected from the Westmoreland mine. Impacts from rail traffic are not considered to be significant in that EIS despite its higher projection of coal traffic.

The increased coal production would contribute to more rail traffic on the Burlington Northern main line to the midwestern barge load-out facilities at Pigs Eye terminal in Minnesota. During winter, the additional train traffic would add to existing problems sometimes confronting rail traffic. (See Transportation, chapter II.) Coal barge traffic on the Mississippi would also necessarily increase and create more congestion on the existing river transportation, particularly during winter.

M. RECREATION

Impacts on recreation in Big Horn County are not expected to be significant. The population increase associated with the mine, the proposed improvements to FAS 384, and the relocation of the county road would likely cause slight increases in the use of public and private lands and existing recreation facilities. Increased demands on lands and recreational areas would likely result in a decrease of the quality of the recreational experience instead of a decrease in recreational opportunities. Because none of the land in and around Tract III is publicly owned, a potential for increased conflicts between landowners and recreationists exist. Further, a potential exists for increases in confrontations between Indians and non-Indians similar to the controversy over fishing in the Big Horn River. Additional impacts resulting from increased recreational use would include increased maintenance costs for facilities and a potential increase in litter and pollution at both developed and undeveloped sites.

N. CULTURAL RESOURCES

Six historic sites and two archeologic site would be destroyed during the 20-year mining plan. (See Cultural Resources, chapter II.)

All of these sites have been reviewed by the State Historic Preservation Officer for eligibility for inclusion on the National Register of Historic Places and have been determined not eligible (appendix B). Impacts would therefore not be significant, except to local residents who value the old homesteads that would be destroyed.

Additional undiscovered archeological sites may exist in the mine area, the destruction of which could potentially be a significant loss to man's understanding of prehistory. This impact, however, cannot be predicted with any reliability.

A beneficial effect of development would be the gain in knowledge derived from the cultural resource investigations which otherwise might not have been undertaken.

O. ESTHETICS

The greatest impacts on esthetic qualities would be the destruction of additional scenic and visual resources with the progression of mining; and, the perpetuation of an industrial setting imposed upon a rural environment. Because of the isolated location of the minesite, however, relatively few people would be exposed to those impacts. To the dozen or so families living near the mine, the esthetic impacts would probably be significant; however, the mine would negligibly disturb regional esthetic values. The mine would be visible only from limited areas outside of Tract III.

The relocation of the county road would lessen the impacts somewhat by routing traffic through an area from which mining operations would be less visible. Odors from vehicle emissions, fugitive dust, and sounds related to mining would continue to disrupt the formerly clean, quiet rural area.

Following mining, quiet would return to the minesite and the visual signs of mining would be largely camouflaged by reclamation. Although not visually offensive, the reclaimed land would lack much of the scenic appeal that previously existed.

CHAPTER IV

MITIGATING MEASURES

Westmoreland Resources, Inc. has proposed a number of measures to mitigate adverse environmental impacts from the Absaloka mine. Those measures, which would be binding if the permit is approved as proposed, are described in chapter I and are considered in the evaluation of environmental impacts in chapter III.

Westmoreland would have to meet the requirements of all applicable laws and regulations before they could mine as proposed in chapter I. A summary of State and Federal laws and regulations which would apply to the Absaloka mine is found in chapter III of DES 79-41 (U.S. Department of the Interior and Montana Department of State Lands, 1979).

At this writing, it is not possible to determine what additional mitigating measures Westmoreland would have to employ (beyond those proposed in chapter I) to conform to existing laws and regulations.

Chapter VIII of this EIS discusses possible additional measures that would mitigate environmental impacts. The Commissioner of State Lands could impose one or more of these "technical alternatives" as stipulations to the mine permit, although such stipulations must be reasonable, noncapricious, and enforceable.

If after the permit were approved it became apparent that proposed and required mitigations had failed or were likely to fail, the Commissioner could impose additional mitigating measures where necessary. Failure of mitigations would be identified through required monitoring and observation during mandatory inspections by the Department of State Lands and other responsible State and Federal agencies.

CHAPTER V

UNAVOIDABLE ADVERSE IMPACTS

Land use on the 2,900 acres disturbed under the remainder of the 20-year mine plan would be significantly curtailed during and after mining. The reclaimed surface could not support as many livestock or wildlife as at present under optimal management. This impact would be due mostly to the destruction of part of a recharge area that supports numerous springs in three coulees north and east of the mine area, which would greatly reduce vegetation in those coulees. The reduction in surface and ground water in the coulees would likely cause a successional trend toward plant species which tolerate drier conditions. The carrying capacity of the reclaimed land for livestock and wildlife would be lowered owing to the cool-season forage which would be supported on the reclaimed area and the increased distance to water.

Impacts on vegetation would be compounded by erosion on as much as three-fourths of the mined area, due to the creation of geomorphically unstable slopes. Much of this impact could be avoided by redesigning the proposed postmining topography; however, some increase in erosion could not be avoided due to alterations of soil structure.

Potential long-term vegetation productivity would be unavoidably lowered by about 10-20 percent on the entire reclamation surface, following several years of initially high productivity. Trees and shrubs such as ponderosa pine and skunkbush, which are important for wildlife, may not be reclaimed, although the company has had some initial success (2 years) in establishing ponderosa pine on reclaimed areas. Riparian plant communities would also likely be lost. These impacts would, in turn, reduce the carrying capacity of the area for many species of wildlife, including amphibians, turkeys, mule deer, white-tailed deer, and several song birds.

Mining under the proposed 5-year plan would have somewhat less significant effects, because less area would be mined (361 acres), and because the grassland and agricultural lands to be mined are easier to reclaim. Hydrologic impacts on the 3 coulees north and east of the 5-year permit area, however, would still occur, thus limiting land use in those coulees.

Although pollutant emissions from the mine would approximately double, existing air quality standards would not be violated, and impacts on human health and vegetation would be limited. Long term exposure to particulate and gaseous pollutants would increase the risk of health problems among workers at the mine, and would probably reduce vegetative productivity within about 1 mile of the active mine area.

Social and economic impacts would not be severe. Most of the population increase would occur in Hardin, but annual growth rates would not be so high as to disrupt the local society. Some of the amenities of life in this rural community would be lost or compromised as the pace of life and accompanying noise and pollution increased. Ranchers near the

mine would continue to see an erosion of their rural, agricultural way of life, due in part to the influx of newcomers, increased traffic, noise, and dust, and the uncertainty over possible additional mining. Conflicts between the white and Crow Indian cultures would likely increase as newcomers, mostly white, moved into the area. Increased royalty payments to the Crow, and the higher incomes of the Crow mine workers, could potentially change the Crow family structure, although this is speculative.

No significant problems for local school districts or Big Horn County are anticipated, because the mine is part of the school districts' and the county's tax base. Hardin would have some difficulty financing the new primary school which would be needed. Hardin's tax base would not increase as fast as the need for new services but this would only partly be due to the mine. Mental health, drug abuse, and public assistance programs would lag behind demand.

Six historic homesteads and two archeologic sites would be destroyed under the 20-year plan; one historic site would be destroyed under the 5-year plan. Additional unknown archeologic sites could be destroyed despite mitigating measures.

The mine would be an eyesore to those living nearby, although many people visit the mine and presumably accept the way it looks. After reclamation, the minesite would not be a scar on the landscape although it would be noticeably different from surrounding undisturbed land.

CHAPTER VI

SHORT TERM USES VS. LONG TERM PRODUCTIVITY

Coal from the Absaloka mine would produce needed electricity and considerable tax revenues, royalties, and jobs. This would be achieved at a cost of long-term vegetative, wildlife, and livestock productivity at and near the minesite.

Under the proposed production schedule, 39.5 million tons of coal would be mined from 1980 through 1984 and 169.5 million tons would be mined through 1997 (the end of the current 20 year mine plan). This would amount to 17 percent of the total projected coal production from all mines in the northern Powder River basin of Montana. The coal would be used to generate electricity in the upper Midwest.

From 1980 through 1997, Westmoreland Resources, Inc. would pay a total of about $288 million in State severance taxes (at the most recent price), lesser amounts of other taxes, and about $99 million in royalties to the Crow Tribe of Indians. Local school districts would find it easier to finance their operations.

Following reclamation of the 20 year permit area, potential vegetative productivity would be about 10-20 percent below current potential productivity due to impacts on soils and hydrology. This would result in a long-term loss of about 0.13 animal-unit-months of forage per acre. This would translate to the loss of about 15,000 pounds of beef per year, compared to what could have been produced under optimal management had the land not been disturbed. A loss of that magnitude would not significantly lower total livestock production from the Sarpy Creek basin.

Reclaimed soils would require specialized management for many decades to prevent undue erosion, compaction, and further loss of vegetative productivity. Management practices that would be acceptable on nearby unmined lands would likely cause problems on the reclaimed minesites.

Wildlife populations on the reclaimed land would not be nearly as diverse after mining, and long-term carrying capacity for mule deer, white-tailed deer, turkey, amphibians, and some songbirds would be reduced. As a result, use of the land for hunting and viewing of wildlife would be reduced.

The opportunity for in-place study of archeological sites would be lost, although none of major importance are known to exist in the area to be mined.

The town of Hardin would become more urban, at a cost of a slower, rural way of life. The 35-50 acres of land used for new residential development in and around Hardin would be lost to other uses, mostly agricultural. Population increases would lower the quality of recreational experiences in the county by some small amount.

Big Horn County would become more dependent on mining, subjecting the tax base to increasing risk of fluctuation due to changes in mine production. This would increase interest rates for the county and thus make it more difficult for them to finance needed services. The Crow Tribe could develop a similar dependence on royalties from the mine.

CHAPTER VII

IRREVERSIBLE AND IRRETRIEVABLE COMMITMENTS OF RESOURCES

By 1998, the end of the current 20 year mine plan, the Absaloka mine would recover about 169.5 million tons of coal from Tract III. About 23 million tons would not be recovered in the mining area, owing to the limitations of present technology.

The mine would use fuel and power at about the same rate as other strip mines in the region--an estimated 1.7 million gallons of diesel fuel, 197,000 gallons of gasoline, and 43 million kilowatt hours of electricity annually at the full coal production level of 10 mty. Unit trains would consume about 26 million gallons of diesel fuel each year to transport the coal to midwest utilities. The energy directly used to mine and ship the coal would be the equivalent of about 7 percent of the energy contained in the electricity generated from the coal.

Water consumption at the mine would amount to 280 acre-feet/year from the Madison aquifer. The increased population of Hardin attributable to the mine would require another 130 acre-feet/year. Neither direct nor indirect uses would exceed existing water rights and supply capacities, nor would they interfere with other uses of water in the Yellowstone Basin.

Based on prior experience at the mine, about 130 man-days would be lost from accidents over the life of the mine. There have been no deaths to date at the mine, but a few could possibly occur.

During mining, livestock grazing on the permit area would be reduced by a maximum of 1,100 animal-unit-months/year, assuming total exclusion of livestock from mining and early reclamation areas. Following reclamation, the disruption of the hydrologic system and disturbance of soils and vegetation would reduce livestock and wildlife carrying capacity below potential for the long term. The reduction would amount to about 323 animal-unit-months/year, which would still not appreciably reduce total production from the Sarpy Creek drainage basin.

Wildlife species which depend on riparian, ponderosa pine, and skunkbush habitat types would be largely eliminated from the minesite for decades after reclamation.

Hardin's trend toward a more urban area would continue with the mine. The gradual loss of the slower pace of life of a rural community would be lost as long as mining continued. Tax revenues from the mine would assume an increasingly important position in Big Horn County, which would tend to make the county dependent on continued coal mining.

Six historic sites and one archeologic site would be lost, and any undiscovered sites would probably also be lost to scientific study.

CHAPTER VIII

ALTERNATIVES TO APPROVING THE PERMIT AS PROPOSED

This chapter considers alternatives to approval of Westmoreland's proposed mine plan. The administrative alternatives available to the Commissioner of State Lands include denial of the permit, selective denial of portions of the permit, and approval of the permit subject to stipulations. Possible stipulations which would reduce the environmental impacts identified in chapter III are discussed as technical alternatives. Any of these alternatives could be chosen if necessary to reduce the environmental impacts of the proposed mining or to comply with legal requirements and the lease terms.

If Westmoreland's current permit application were denied, and no further permits were issued on its Tract III lease, Westmoreland would continue mining under its current State permit in Section 36. Mining in Tract III would cease at the end of 1979; in Section 36, at the end of 1985. (See table VIII-1.) The impacts of this scenario are evaluated as the "low production level" in this chapter.

Westmoreland would undoubtedly propose a different mine plan within its Tract III lease if the current permit application were denied. The EIS prepared by the U.S. Bureau of Indian Affairs (FES 76-64, U.S. Department of the Interior, 1976) evaluates possible environmental impacts of mining within different areas of Tract III. That evaluation is not as detailed as in this EIS, due to the lack of a detailed mine plan, and is not strictly comparable to the discussion in chapter III of this EIS.

This chapter also considers the environmental impacts if Westmoreland were to expand production to 15 mty by 1988. (See table VIII-1.) This "high production level" would satisfy the terms of Westmoreland's lease from the Crow Tribe. The Commissioner of State Lands does not have the authority to require a high production level, although he would have to approve additional permits for Westmoreland to reach that level. Under the production level evaluated in chapter III (10 mty), Westmoreland would have to pay minimum royalties or return a portion of their coal leases to the Crow Tribe.

A. ADMINISTRATIVE ALTERNATIVES

1. Department of State Lands

If no action were taken by the Department within 240 days after receipt of a complete application for a mining and reclamation permit, the permit would be statutorily approved by default.

The State also does not have a formal administrative alternative to "defer action" following the receipt of a completed application for a mine and reclamation permit. However, the State may deem an application incomplete due to failure of the mine plan to meet State requirements, leading to a postponement of the action, which has the effect of deferral.

TABLE VIII-1.--Westmoreland coal production levels (millions of tons)

	HIGH			LOW (NO PERMIT)		
Year	State Sec. 36	Tract III	Total	State Sec. 36	Tract III	Total
1974----	0.0	1.5	1.5	0.0	1.5	1.5
1975----	0.0	4.0	4.0	0.0	4.0	4.0
1976----	0.0	4.1	4.1	0.0	4.1	4.1
1977----	0.0	4.5	4.5	0.0	4.5	4.5
1978----	0.0	4.6	4.6	0.0	4.6	4.6
1979----	0.6	4.7	5.3	0.6	4.7	5.3
1980----	2.55	4.7	7.25	5.3	0.0	5.3
1981----	2.55	4.7	7.25	5.3	0.0	5.3
1982----	2.55	7.45	10.0	5.3	0.0	5.3
1983----	3.05	6.95	10.0	5.3	0.0	5.3
1984----	5.3	4.7	10.0	5.3	0.0	5.3
1985----	5.3	4.7	10.0	4.5	0.0	4.5
1986----	5.3	4.7	10.0	0.0	0.0	0.0
1987----	3.8	11.2	15.0	0.0	0.0	0.0
1988----	0.0	15.0	15.0	0.0	0.0	0.0
1989----	0.0	15.0	15.0	0.0	0.0	0.0
2000----	0.0	15.0	15.0	0.0	0.0	0.0

Other than the decisions to approve or disapprove a permit, only two alternatives are open to the State: (1) approval of the permit with modification; and (2) selective denial of the permit to mine in a specified area that includes lands having special, exceptional, critical, or unique characteristics, or where mining would affect the use, enjoyment, or fundamental character of neighboring land having the above special characteristics. Either or both of these alternatives, which could be legally invoked after the permit application was deemed complete, would generally be exercised by the Department during its review of the application, thereby making modification and/or selective denial prerequisite to the acceptance of a completed application. Possible stipulations to the mining permit which would reduce environmental impacts are discussed under Technical Alternatives.

The Commissioner may reject a proposed plan that does not meet the applicable laws and regulations under his authority. If the Commissioner were to reject Westmoreland's current plan, the company would have to shut down its operations in Tract III at the end of 1979. The company would continue mining under its existing permit in Section 36, as discussed in this chapter under the "low production level". Westmoreland would likely submit a new permit application for some other area within its

Tract III lease. The resulting environmental impacts are difficult to predict, particularly for mining within a different area of the lease.

Until a revised mine plan were submitted and approved, the lease would continue in its present condition, subject to modification by natural processes and by the continuation of other existing activity and uses--and to further modification by the surface owner to meet other uses. However, the development of alternative sources of energy, such as other coal mines in the county, or a reduction of national energy consumption, could result.

2. Department of Health and Environmental Sciences

Under the Montana Clean Air Act, the Department of Health and Environmental Sciences has the authority to take action on the application for a permit to construct and operate coal-handling facilities. The Department would review the designs for the coal-crushing, storage, and loadout structures and the plans for the operation of coal-handling facilities after construction, in order to ensure that the best possible control technology would be applied toward preventing and abating air pollution.

Three administrative alternatives open to the Department are disapproval, approval, or approval after acceptable modification of the construction and/or operating designs.

Decisions of the Department of Health and Environmental Sciences are not contingent on those of the Department of State Lands, with the result that disapproval by either agency would cause rejection of the entire project. The impacts due to disapproval of a permit for coal-handling facilities would therefore be the same as those from rejection of the mine and reclamation permit. Impacts due to approval of the coal-handling facilities are those analyzed in chapter III. Impacts that would result from modification of the designs for construction and/or operation of coal-handling facilities are discussed under Technical Alternatives.

B. LOW PRODUCTION LEVEL

This level of coal production examines the environmental impacts that would be expected if no further permits were issued to Westmoreland within its Tract III lease. Operations in Tract III would cease at the end of 1979. Mining would continue in Section 36 until the coal in that section was exhausted--the end of 1985 under the production level shown in table VIII-1.

Summary of impacts

The remainder of Tract III would not be disturbed and its current grazing and wildlife potential would be conserved. About 1330 fewer acres would be mined. Because there is less coal per acre, on the average,

in Section 36 than in Tract III, the acreage which would be mined per million tons of coal would be approximately 30 percent greater. At 5 mty, 72 acres/year would be mined as opposed to 55 acres/year from Tract III.

Hydrologic impacts on the East Fork Sarpy Creek basin (see chapter III) would not occur. Inasmuch as current mining in the area has not breached the surface or ground water divides between Middle Fork and East Fork, there is no reason to believe that impacts on the East Fork basin, presently negligible to nonexistent, would worsen. As a result, all hydrologic impacts would remain in the Middle Fork basin.

Hydrologic impacts in the Middle Fork basin were discussed in a previous EIS (Montana Department of State Lands, 1977). Two springs, Nos. 237 and 238, would be removed by mining, and an additional spring, No. 277, could well experience decreased or total cessation of flow. (See figure II-1.) In addition, ground water drawdown due to the mine pit would extend its influence primarily northward and eastward, thereby lowering the nearby ground water table. (See Ground Water, chapter III.) Although existing data are inconclusive, surface mining in section 36 would probably have a negligible impact on Middle Fork Sarpy Creek.

Soils in section 36 differ only slightly from soils in Tract III; therefore, impacts on soils under the low level would not be significantly different from those under the proposed action. Section 36 appears to have a relatively greater amount of soils with a fine-loamy textural classification, indicating soils with more clays than those affected under the 5-year mine plan. This could cause slightly less infiltration and increased runoff. Sediment yield would probably not be materially affected, all other parameters being equal. Salinity may be marginally increased due to the relatively greater representation of Thedalund-Wibaux and Chugter soils. (See Montana Department of State Lands, 1977.)

Air pollutant emissions would continue at about the same level through 1985. Some of the existing monitors would note increases as mining moved closer to them. As in the proposed production level, human health would not be endangered, and impacts on vegetation would be limited to near the active mine pits.

The population of Hardin would grow at an average annual rate of 3.6 percent/year, somewhat less than the 4.5 percent projected in chapter III. Both rates are within what Gilmore and Duff (1975) suggest is stable to moderate. Hardin's population would about double from 1980 to 2000 because of continued slow growth in ancillary employment even without the mine. Social impacts would be similar to those described in chapter III at least through 1985. Shutting down the mine would cause a bust period of a few year's length in Hardin, in which several businesses supplying the mine and its employees could be expected to close.

Impacts on community services would be similar to those projected in chapter III, but the slower rate of growth would make it somewhat easier for planners to meet needs for new services.

Employment at the Absaloka mine would remain essentially unchanged until 1985. The local economy would, however, lose the benefit of the royalty employment equivalent (see Economics, chapter II) which has the effect of about 150 mining jobs. Despite the loss of the royalty equivalent, ancillary employment would continue to grow, but at a slower rate than has recently been the case. The ancillary sector would probably not grow fast enough to replace the construction force which will leave in 1980.

Total employment would also decline after the mine went out of production in 1985. The post-1985 period would see the county return to essentially the premining pattern, i.e., steadily declining economic base employment and very slow growth in the ancillary sector.

The single most important income effect would result from the loss of the royalties paid to the Crow Tribe of Indians. Individual tribal members' income would not increase dramatically as projected in chapter III. Additionally, the Tribe has committed itself to an extensive land acquisition program and intends to dedicate future royalty payments to repay a $6 million loan. If the royalty payments are not forthcoming, the loan would have to be delayed indefinitely.

At the most recently reported contract sales price (March 1979) the State would not realize approximately $9 million annually in severance taxes should the mine production fall to zero from the current level.

Local fiscal effects would begin to occur in 1986, about 1 year from the production decline. About 17 percent of the county's tax base, and about half of the two affected school district's tax base would be lost in 1987. The tax rate would have to increase correspondingly, because the county's and school districts' costs would remain about the same. In fact, some county costs (particularly public assistance) could go up with the closure of the mine. School district costs are more fixed than county costs and would become a problem after the mine closed. For example, most of the voted levy in the two school districts is dedicated to debt service. This need for revenue is in effect for the life of the bond issue, not the life of the mine.

C. HIGH PRODUCTION LEVEL

Under the terms of their Tract III lease from the Crow Tribe, Westmoreland must reach a production level of 15 mty by 1987, or pay minimum royalties to the Tribe, or return a portion of the lease to the Tribe. This production level evaluates a high level of coal production reaching 15 mty by 1988 as shown in table VIII-1.

Summary of impacts

The high level of production would have much the same effect on land use as the proposed action. However, land would be disturbed somewhat

more rapidly. Starting in 1987, about 55 additional acres would be mined annually--about 165 acres/year, compared to 110 acres/year under the proposed action. The disturbances of soils, topography, vegetation, wildlife, hydrology, cultural resources, and esthetics would be virtually the same as projected in chapter III, except that they would begin to occur sooner. Westmoreland would mine out the area within its 20 year plan more rapidly, and continued production would have to come from a different part of Tract III. Impacts of mining other areas within Tract III cannot be predicted with any accuracy. FES 76-64 (U.S. Department of the Interior, 1976) contains a generalized assessment of the impacts of mining within Tract III.

There would be a more marked increase in particulate and gaseous emissions. Violations of ambient air quality standards would probably occur more frequently than permissible. Human health would probably not be endangered. The effects on vegetation and animal life would be short term if noticeable.

Hardin would grow at an annual rate of 4.9 percent--slightly higher than the 4.5 percent projected in chapter III. Growth would be at the high end of what Gilmore and Duff (1975) call stable to moderate. With proper planning, Hardin and Big Horn County would be able to anticipate and provide needed services, but the necessary planning has not occurred in the past for a variety of reasons (McQuiston, 1979). As a result, some social services such as mental health, drug abuse, and welfare may not be adequately provided.

Conflicts and stress within the local society would increase as a result of growth. The types of problems would be the same as in chapter III.

The high level of production would result in a more rapid rate of job formation in Big Horn County. The employment in the ancillary (derivative) sector would increase at an annual rate about 7 percent greater than the proposed action and about 30 percent greater than what would have been the case had there been no Absaloka mine. The jobs at the mine and the royalty payment to the Crow Tribe would generate about 300 additional ancillary jobs by 1985 (about 150 exist already). The mining and construction jobs would be responsible for about 60 percent of the new ancillary jobs and the royalty payment for the remainder.

Starting in about 1987--sooner if the Crow Tribe successfully negotiates improved lease terms--the royalty payment would be larger than the mine payroll. Between 1985 and 1990 the high level of production would create about 300 more ancillary jobs, in addition to the 150 additional jobs at the mine. The royalty payment would be responsible for more than half of the ancillary increase and would continue to be the dominant force in job formation in Big Horn County for the rest of the century.

The royalty payment to the Crow Tribe would likely be the single largest source of personal disposable income in Big Horn County after

1985. The royalty payment would result in a 1990 per-capita payment in excess of $1,000--more than $5,400 a household, assuming no changes in lease terms, F.O.B. mine price, Crow population trends, or disposition of the royalty payment. An increase in income of this magnitude would exert a considerable effect upon the Crow culture and in turn upon Big Horn County as a whole. In all, about half of the county's residents would be a source of economic and social change, instead of a relatively small number of mine workers. There has not been sufficient research on this topic to do more than speculate about the probable consequences of a change of this magnitude, despite its being the single most important and perhaps critical source of economic and in turn political and cultural change in the county.

The fiscal effects of the high level of production are very similar in form to those of the proposed action. The magnitudes would be somewhat greater.

D. TECHNICAL ALTERNATIVES

Alternatives such as different mining procedures, changes in the mine configuration, or changes in the method of coal transport have been considered. It does not appear, however, that such changes would be viable, and some, such as underground mining, would probably not reduce the impacts of mining. If any such alternatives are suggested in the review process, they will be considered in the final EIS. A discussion of the possible effects of such modifications is presented in chapter VIII of FES 77-17 (U.S. Department of the Interior, 1977).

The technical alternatives described below appear to be viable and would reduce environmental impacts.

The Commissioner could require that Westmoreland redesign its proposed reclaimed slopes to a complex morphology. The Department has sent a letter to the company requesting a statement on the intent of the company regarding the postmining configuration of reclaimed slopes.

Based on both onsite results and observations made in the literature, it is apparent that postmining reclamation surfaces finished to complex slopes instead of the proposed straight and slightly convex slopes would reduce erosion rates and sediment yield, and contribute to reclamation success. The degree to which erosion would be reduced depends on other parameters, notably infiltration capacity, soil texture and structure, storm duration and intenstiy, vegetative cover, root development, and management practices.

Reclaimed acreage at the Absaloka mine contains different sites with a range of erosion rates. Those areas with the least development of rills and gullies and minimal apparent sheet erosion have slope morphologies with a complex (convex-concave) configuration. Although other factors also affect erosion rates, slope configuration is a very important

component, and is most easily manipulated in reclamation. Hadley and Toy (1977) found that straight slopes eroded twice as fast as either convex or concave slopes. (It is likely that their measurements on convex slopes were relatively low due to low overland flow. They used natural slopes, with the convex portion near the crest.) Others (Wischmeier and Meyer, 1973) have cited increases in sediment load for convex and straight ("uniform") slopes, and decreasing loads for complex and concave slopes with increase slope length. They further state that construction sites finished concave slopes can expect less erosion than those finished to uniform or convex configurations.

Initial reclamation costs would be somewhat increased under this alternative. In the long run, costs might be less because the need to correct spot reclamation failures due to erosion would be reduced. Redesigned slopes would also require the regrading of slightly more spoil, although proper design of the slopes would minimize this problem.

The Commissioner could require that Westmoreland replace "A" horizon topsoil by direct lift and laydown. The Department is not presently requiring that this handling of topsoil be used; however, the Reclamation Division is evaluating the benefits of requiring such methods.

A major cause of topsoil degradation is induced by storage and excess handling of "A" horizon material between salvage and placement on the regraded spoils. Storage and the necessary increase in handling contributes to severe alterations in microorganism populations, loss of plant propagules and seeds, reduction of soil organic matter and aggregation, and changes in nutrient status.

Major changes in operating procedures would be necessary to significantly increase the amount of direct lift and lay down. With the recent introduction of double lift and lay down at the Absaloka mine, there is a possibility of laying down the "B" and "C" (subsoil) material from stockpiles well in advance of the "A" horizon. With this approach, stockpiled subsoils could be applied to regraded spoils and stabilized, if necessary, with either mulch or annual ground cover species during much of the year. Direct lift and lay down of the "A" horizon, probably in the fall during plant dormancy, would have to be a highly organized, high priority undertaking during the 2 to 3 weeks required. The results would include a more resilient soil and higher survival rates of desirable perennial grasses and shrubs from native range.

Costs under this alternative would not be more than under the current proposal, and could be less; the major difficulty would be the degree of planning and organization required. Scrapers would have to be made available at the proper times for direct salvage, which could interfere with ongoing mining operations if not properly planned.

The Commissioner could recommend, initiate, or fund a study of erosion rates (sediment yield) from reclaimed surfaces at the Absaloka mines.

The present state of reclamation is largely experimental, in that interrelationships between and among the various components of the disturbed systems are poorly understood. Continued advances in reclamation will depend in large part of quantification of those factors which significantly affect reclamation.

Lusby and Toy (1976) suggest that sediment yield from reclamation surfaces (compared to adjacent undisturbed areas) would be "...a valuable parameter for evaluating rehabilitation practices because it integrates the effect of slope, soil properties, and vegetation properties." Quantifying the relative contribution from these properties to sediment yield would be useful in planning future reclamation efforts.

Reclamation at the Absaloka mine to date, as noted in chapter III, includes areas with apparent erosion rates ranging from very low to moderately severe. A study of the chemical and physical properties of topsoils and spoils, slope length, degree and morphology, vegetative cover, and erosion rates and their interrelationships would permit an approximation of the influence exerted by the principal causative factors controlling erosion and their thresholds on mined lands. For example, with adequate information, slope length and morphology may be designed to minimize the high erosive potential of sandy soils. (See technical alternative of redesigning slopes.)

Full knowledge concerning the interactions of the various components of a disturbed system would allow optimal allocation of available resources for planning stable reclamation surfaces.

CHAPTER IX

CONSULTATION AND COORDINATION

A. DEVELOPMENT OF THIS STATEMENT

Westmoreland Resources, Inc. submitted its application to the Montana Department of State Lands for a strip mining permit under the Montana Strip and Underground Mine Reclamation Act on July 21, 1978. The Department began preparation of this EIS shortly thereafter, in compliance with the Montana Environmental Policy Act.

The Northern Powder River Basin EIS Team, attached to the Department of State Lands, analyzed Westmoreland's proposal and wrote the Draft EIS under the direction of the Department. Persons who directly contributed to the EIS are listed in appendix D.

Information and comments were solicited from a number of State and Federal agencies, county and city officials, consultants, and citizens prior to publication. Agencies and groups which provided information or reviewed parts of the EIS are listed below.

<u>Government</u>:

U.S. Department of the Interior--Bureau of Indian Affairs
--Bureau of Land Management
--Geological Survey

U.S. Department of Labor--Mine Safety and Health Administration

State of Montana--Office of Superintendent of Public Instruction
--Legislative Council
--Department of Community Affairs
--Department of Health and Environmental Sciences
--Department of Social and Rehabilitation Services
--Department of Revenue
--Department of Highways
--Department of Labor and Industry

Big Horn County--School Superintendent

<u>Non-Government</u>:

Burlington Northern Railroad
Crow Tribe
Westmoreland Resources, Inc.
Friends of the Earth
Montana State University

The analysis of hydrologic impacts, and part of the analysis of geomorphic impacts was provided under contract by a private consultant. (See appendix D.) Some of the maps used in the EIS were drafted by Olson-Elliott and Associates, Inc., of Helena, Montana.

Westmoreland Resources, Inc. provided data and information on their existing and proposed operations and assisted team members with field observations and data collection. Chapter I of this EIS was reviewed by Westmoreland for technical accuracy, but the remainder of the EIS has not been reviewed by the company or other people outside State or Federal governments prior to publication.

B. REVIEW OF THIS STATEMENT

In accordance with the regulations governing environmental impact statements of the Department of State Lands, copies of the draft EIS will be made available to the public for their comments and suggestions. Comments are also being solicited from various agencies and organizations, including those listed above. All comments received will be carefully considered in the preparation of a final EIS. Written comments should be addressed to the Department.

The draft environmental statement is available for review in the following places:

- Montana Department of State Lands, 1625 11th Avenue, Helena, MT 59601
- Big Horn County Public Library, 419 North Custer Ave., Hardin, MT 59034
- The Rosebud County Library, 201 North 9th Ave., Forsyth, MT 59324
- Parmley Billings Public Library, 510 North Broadway, Billings, MT 59103
- Sheridan County Fulmer Public Library, 320 North Brooks, Sheridan, MT 82801

A limited number of copies are available on request from the Department of State Lands, Capitol Station, Helena, MT 59601.

CHAPTER X

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CHAPTER XI

APPENDIXES

DEPARTMENT OF STATE LANDS

CAPITOL STATION, HELENA, MT 59601
(406) 449-2074

STATE OF MONTANA

THOMAS L. JUDGE, GOVERNOR
LEO BERRY, COMMISSIONER

APPENDIX A
[Retyped for clarity]

August 10, 1979

Mr. Ralph Moore
Vice President, Operations
Westmoreland Resources, Inc.
P. O. Box 449
Hardin, MT 59034

RE: Permit Application 00068

Dear Ralph:

As you were made aware during our meeting on August 7, the Department of State Lands has found serious hydrological and related problems with Westmoreland's five-year mining plan application for the East Fork Sarpy Creek Basin. Application review to date has revealed that Westmoreland's application may be unacceptable because the mining and reclamation plan may not meet the criteria set forth in the following portions of the Montana Strip and Underground Mining Reclamation Act and the Department's rules adopted pursuant to the Act.

1. Section 82-4-227 MCA states:

> "An application for a prospecting, strip mining, or underground mining permit shall not be approved by the department if there is found on the basis of the information set forth in the application, an on-site inspection, and an evaluation of the operation by the department that the requirements of this part or rules will not be observed or that the proposed method of operation, backfilling, grading, subsidence stabilization, water control highwall reduction, topsoiling, revegetation, or reclamation of the affected area cannot be carried out consistently with the purpose of this part."

Review of Westmoreland's application to date reveals that the mining reclamation plan may not meet the revegetation performance standards set forth in 82-4-233(1)(a).

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With respect to this first point, the department is specifically referring to spring number 276 and its dependent riparian vegetation.

2. Application review to date shows that the mining of all or a major portion of the proposed permit area may adversely affect the use and fundamental character of neighboring land having special, exceptional, critical or unique characteristics. Areas adversely impacted by Westmoreland's proposed five-year mining plan may be ecologically fragile in the sense that such areas once adversely affected could not return to their former ecological role in the reasonable foreseeable future (82-4-227(2)(6)MCA). The department is specifically referring to the upper portions of three coulees extending northward and northeastward from the proposed permit area and which contain numerous groundwater discharges in the form of springs and seepages and wet areas.

   In addition to these off-site areas, the department believes that spring number 276 and its dependent riparian vegetation may also be ecologically fragile and nonreclaimable. Spring number 276 is within the proposed five-year permit area and would thus be removed by mining.

3. Application review to date also shows that Westmoreland's proposed mining and reclamation plan may not minimize disturbance to the prevailing hydrologic balance of the area. The department feels that adverse long-term changes in the hydrologic balance of areas to the north and east of the permit area may occur, and hence that ARM 26-2.10 (10)-S10330(1) may not be satisfied should Westmoreland's application be approved.

4. Application review to date also shows that Westmoreland's proposed reclamation plan may not provide for restoration to the approximate premining recharge capacity. Existing data reveals that the capability of the reclaimed areas as a whole to transmit water to the groundwater system may not be restored as is required in ARM 26-2.10(10)-S10330(9).

   Westmoreland's proposed five-year permit area lies in the heart of the recharge area of the overburden middle siltstone aquifer, the water-bearing body responsible for a significant number of springs, seepages, and wet areas in three coulees extending northward and northeastward from the mine area as well as spring number 276 on the proposed permit area. Review of the application shows that mining of the proposed five-year permit area would physically remove between 40 percent and 60 percent of the effective recharge area of the middle siltstone aquifer and would thus eliminate essentially all the recharge to this aquifer.

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As a result, discharge of the water from the middle siltstone aquifer in the upper portions of the three coulees would be significantly lowered and may cease in spots. The middle siltstone aquifer provides a line-source of water in these coulees as evidenced by springs, seeps, and wet areas. In addition, drawdown from Westmoreland's mine pit both during and after mining would further reduce groundwater flow towards such springs, seepages and wet areas.

Once the proposed permit area is mined and the groundwater discharge from the middle silt aquifer has either ceased or been diminished, such changes would be permanent. Springs which issue from the coal beds (Rosebud-McKay and Robinson), if impacted by mining, might reestablish themselves after reclamation, (possibly as late as 150 years later), as groundwater levels rose in the reclaimed pit. However, the coal beds are most likely transmissive enough to prevent groundwater levels from rising above the Rosebud-McKay coal bed so that the groundwater levels would never be reestablished in the middle siltstone aquifer.

Supplementary and hydrologic analysis may be found in the attached memos by Jim Osiensky and Dave Stiller.

Loss of the springs and the associated drop of the groundwater table would adversely affect the existing vegetation matrix in and adjacent to the upper reaches of the three coulee bottoms. A successional trend toward plant species which tolerate drier conditions would slowly occur as species requiring riparian or wetland conditions would be eliminated over a period of time. The more xeric species which replace the existing vegetation matrix would result in less species diversity and significantly decrease vegetative productivity below that which now occurs in the area.

Loss of the springs and seepage areas, and the resultant change in coulee bottom vegetation would have a pronounced change in both on and off-site wildlife use. Complete habitat loss for amphibians would occur, while species such as turkeys, deer, ducks and numerous song birds would be forced to seek out other areas that represent the same habitat needs now satisfied by the diverse, dense, coulee bottom vegetation and related wet areas (cover, food, nesting and fawning areas, water, sanctuary, etc.). Because the existing water-vegetation complex would not return over time, the overall wildlife carrying capacity for the area may be permanently reduced.

I have presented a synopsis of the department's major points of issue with Westmoreland's proposed five-year mining plan. Permit evaluation of Westmoreland's application by the Department of State Lands will cease until Westmoreland has had an opportunity to respond to the issues raised in this letter. I, or any other member of the Reclamation Division staff, would be happy to discuss the four points raised in this letter with you in greater detail. We would also be happy to review any additional data you may wish to submit.

Sincerely,

/S/

Brace Hayden
Administrator
Reclamation Division

kl

Attachments

c: Don Crane

[Retyped for clarity]

2065 Colorado Gulch
Helena, Montana 59601

July 24, 1979

Mr. Brace Hayden, Administrator
Reclamation Division
Montana Department of State Lands
Helena, MT 59601

Dear Brace:

Pursuant to my contract with the Department, I have undertaken a review of the hydrology of the Westmoreland's Resources, Inc. Absaloka Mine area and have prepared an analysis for inclusion in the EIS nearing release. This analysis is available to you, I believe, through Ralph Driear. However, I wish to summarize these findings for you and to set forth further observations which hopefully will supplement the review by your staff.

In an effort to decrease wasted motion and EIS bulk, I concentrated my efforts on three focal issues. These issues were discussed with, and decided upon, with the concurrence of Department and Westmoreland personnel several months ago. They are: first, what impacts would occur under the proposed five year plan to numerous springs located north of the mine area; second, what impacts would occur to the drainage located immediately east of the mine area and which flows generally northeastward to enter East Fork near the county bridge; and third, what impacts might occur to the East Fork itself. The twenty year plan was also reviewed, but in less detail.

My basic conclusions are as follows. Mining under the five year plan will physically remove at least 40% of the estimated recharge area for many of the springs located in the heads of the coulees north of the mine area. This, in conjunction with subsequent aquifer de-watering caused by pit drawdown, will probably lower the ground water table and cause all springs receiving recharge from the overburden to cease flowing. Flow disruptions would begin within several years after mining breaches the ground water divide and would increase in extent and severity until a new ground water equilibrium is established, probably not for at least several decades. Analysis of water chemistry and geology strongly suggests that perhaps several of the ten springs north of the mine area may receive recharge wholly or partially from Rosebud-McKay burn areas; data submitted by Westmoreland tends to confirm this. Such springs may be unaffected by mining under the five year plan. Nonetheless, most of the perennial spring discharge and water movement in the subject coulees originates from the overburden and would be lost upon mining. It is notable that impact to the springs would be permanent; they would not reoccur following mining.

Impacts to the drainage east and northeast of the mine area are less severe (Sections 29 and 32 and E 1/2 of Sections 30 and 31). The mine pit under the five year plan probably does not breach the ground water divide to the east, but pit drawdown would extend into the upper reaches of that ground water basin and may subsequently affect spring 277. In general, I do not expect mining under the five year plan to more than slightly decrease down-coulee ground water movement east of the mine area.

Insofar as impacts to East Fork Sarpy Creek are concerned, mining under the five year plan should have no measureable or significant impacts to surface or subsurface flow, or in water quality.

It is only logical to assume that the proposed five year plan is but the first portion of the twenty year plan approved by the U.S. Geological Survey several years ago. Consequently, I reviewed general hydrologic impacts which could be expected under such a plan. I refer you to my EIS analysis for greater detail, however, I have concluded as follows. First, all of the ten or so springs immediately north of the current mine area will be physically removed by mining; in addition, an even greater area would be dewatered by pit drawdown. Second, significant impacts to the drainage east of the mine area would occur, probably resulting in lowered water table and the loss of several additional springs located east of spring 277. And third, because the twenty year area comprises 2.5% of the East Fork Basin, mining under the twenty year plan may ultimately impact East Fork proper. Inasmuch as East Fork may meet preliminary criteria for alluvial valley floor designation, such an occurrence would certainly warrant special concern by the Department.

Given that predicted impacts are reasonably accurate, two general conclusions may be reached. First, the springs north of the mine area would be lost as a result of mining under the five year mine plan. And second, the excellent potential exists that significant impacts would occur to East Fork Sarpy Creek at some point in time beyond five years and within twenty years of the proposed twenty years of mining. In this latter case, data are currently not sufficient to be more accurate.

With respect to data adequacy, I have several additional observations to make. It is notable that considerable sums have been committed by Westmoreland Resources to establish a hydrologic monitoring program. Nonetheless, it is equally as disturbing that for all the observation wells which have been established and monitoring systems which have been proposed, major data gaps still exist. Much 1978 data was apparently uncollected, and it is my understanding that a major spring discharge monitoring program is at least several months behind schedule. Further, I believe Westmoreland Resources was requested at least two years ago to accurately quantify ground water flow in East Fork, as well as the contributing ground water flow from coulees draining Tract III. To my knowledge, this has yet to be accomplished. Gaps in the data record are a major reason why analyses to date have not been more quantitative, and can only be a hindrance to any judgments which must be made regarding

the hydrologic system. By lamenting the lack of specific data, I am not questioning the competence or diligence of those Westmoreland professionals with whom I have worked. The professionalism evidenced by Westmoreland technical staff is equal or superior to that of most other organizations I have worked with. The fact remains, however, that data reportedly requested more than two years ago is not available. Certainly there are individuals more familiar with the monitoring program than I am, and I recommend that an effort be made to account for these data and inadequacies. The exact status of this situation would appear to be a determination more fitting of your Department.

If I may be of further assistance in your continuing work on the Westmoreland proposal, please do not hestiate to contact me at your convenience.

Sincerely,

/S/

David Stiller
Consulting Hydrologist

DEPARTMENT OF STATE LANDS

CAPITOL STATION, HELENA, MT 59601
(406) 449-2074
THOMAS L. JUDGE, GOVERNOR
LEO BERRY, COMMISSIONER

STATE OF MONTANA

MEMO [Retyped for clarity]

To: Brace Hayden

From: Jim Osiensky

Re: Hydrologic impacts of mining at Westmoreland

Date: 7-9-79

Preliminary analysis of the existing data indicates that there will be an adverse impact to the hydrologic balance in the upper East Fork Sarpy Creek drainage as a result of mining.

The proposed 5-year permit area lies in the heart of the recharge area of the overburden middle siltstone aquifer.

Groundwater discharge in the form of springs and seepages occurs as a line source along the outcrop of the middle siltstone. It seems certain that a portion and very possibly all of this line source of wildlife, vegetation and livestock water supply will be lost as an indirect result of mining the 5-year permit area.

It appears that mining of the proposed 5-year permit area would physically remove between 50% and 75% of the effective recharge area of the middle siltstone aquifer and indirectly eliminate essentially all of the recharge to this aquifer.

Comparison of the groundwater potentiometric surface, and surface geologic data indicates close correlation between the potentiometric high (groundwater divide) and surface exposure of the middle siltstone aquifer. This suggests that the primary source of recharge to the middle siltstone aquifer is precipitation and snowmelt in close proximity of the groundwater divide where the middle siltstone is exposed at the land surface without overlying or interbedded shales.

Additional data (i.e. age dating analyses and spring recession measurements) will be helpful in the determination of which springs are most likely to be impacted. These data would also help determine when impacts could be expected to occur. For example, mining the recharge area of the middle siltstone aquifer may not have a noticeable affect on the springs for several years. The additional data may be used to show when and where impacts will occur but, the additional data that were requested of Westmoreland cannot be used as a guide to modify the mining plan to allow mining of the area and prevent any impacts to the hydrologic balance.

It must also be noted that once this area is mined and the groundwater discharge in the form of springs and seepage areas ceases the impacts are permanent. Springs which issue from the coal beds (Rosebud-McKay or Robinson), if impacted by mining, may be reestablished after reclamation (possibly 150 years later) as groundwater levels rise in the reclaimed pit. However, the coal beds are most likely transmissive enough to prevent groundwater levels from rising above the Rosebud-McKay coal bed so that the groundwater levels will never be reestablished in the middle siltstone aquifer.

It appears likely, although additional evaluation is necessary, that mining of the northern 1/2 of the proposed permit area will not affect the springs or have a significant imapct on the hydrologic balance of the area. Water level data indicate that this area is dry.

lw

RECEIVED MAY 9 1977

MONTANA HISTORICAL SOCIETY

225 NORTH ROBERTS STREET • (406) 449-2694 • HELENA, MONTANA 59601

May 6, 1977

APPENDIX B

Mr. Douglas Hileman
Deputy Area Mining Supervisor
U. S. Geological Survey
P. O. Box 2550
Billings, Montana 59103

Re: Westmoreland Resources
Proposed 20 year Mining plan
Tract III
Crow Indian Coal Lease
Big Horn County, Montana

Dear Mr. Hileman:

This will advise your office that we have completed our assessment of the historic and archeologic resources on the approximately 640 acres which are involved in the propsed 20 year mining plan.

We find there are no historic or archaeologic sites of National Register significance on the above referenced lands.

We will continue to review the material for the remainder of the lands involved in Tracts II and Tract III and it is our expectation that we could provide the final assessment during this calendar year.

We would like to suggest, for those areas which we have visited on site, that the properties, while not recommended for the National Register, do have some local historic interest. It is possible that local museums or historical groups may be interested in obtaining some of the removable items from various sites. We will bring this to the attention of the mining company at a later date and with somewhat more detail.

The homestead era has been termed by historians as one of the most signific in the state and it is also one which has a direct relationship to many, perhaps most, of the area residents. Accordingly, we will be interested in helping to conserve some of the tangible evidence of this important period.

Thank you for the opportunity to comment.

Yours truly,

Ken Korte

Kenneth L. Korte
State Historic Preservation Officer

KK:AT:vk

CC: Darwin F. Alt, U.S.G.S.
Dave Pennington, B.I.A.
Dave Simpson, Westmoreland Co.

WESTMORELAND RESOURCES
Post Office Box 449, Hardin, Montana 59034 (406) 342-5241

XI-12

May 12, 1977

Mr. Kenneth L. Korte
State Historic Preservation Officer
Montana Historical Society
225 N. Roberts
Helena, MT 59601

Dear Mr. Korte:

Thank you for your letter of May 6, 1977, in which archaeologic and historic clearance was granted for Westmoreland Resources Proposed 20-Year Mining Plan. We appreciate your prompt attention to this matter. The first paragraph of that letter refers to the area of the mining as "approximately 640 acres". The actual acreage is about 2150 acres, all of which was examined by Mr. Al Thompson during his visit of April 20. I spoke with Mr. Thompson by telephone on May 10, and he acknowledged that the 640-acre figure was erronious. Since this acreage value may be questioned during the review process, I thought it essential to clarify the matter by letter at this time. Again, thank you for your consideration.

Sincerely,

David W Simpson

David W. Simpson
Environmental Administrator

DWS:bjz
c: Douglas Hileman
David W. Pennington
Darwin Alt

DEPARTMENT OF STATE LANDS

APPENDIX C

CAPITOL STATION, HELENA, MT 59601
(406) 449-2074

THOMAS L. JUDGE, GOVERNOR
LEO BERRY, COMMISSIONER

MEMO

To: Brace Hayden, Leo Berry & Coal Bureau

From: Dick Juntunen, Assistant Administrator

Subject: Wildlife Habitat Near Springs North and Northeast of Westmoreland's Permit Application No. 00068

Date: August 20, 1979

On July 31, 1979, I inspected ten (10) springs north and northeast of Westmoreland Resources, Inc.'s Application No. 00068. These and a few more springs in the area will suffer dry up or severely diminished flows due to mining, as proposed in Application No. 00068.

The purpose of my inspection was to ascertain the impacts to the indigenous wildlife because of spring flow diminishment.

During the inspection, several different habitat types were observed in association with the spring discharge areas. Areas of closed canopy and heavy undergrowth associated with surface water ranging from seep areas to small ponds with one basic type found around springs 9 and 10. Areas of comparatively open canopy with a marsh type of vegetation over large areas (200 yards long) was another type observed near springs 8 and 13. Some of the springs have substantial ponds associated with the springs and canopy ranges from open to moderately closed around springs 6, 7, 11, 3 and 4. Springs 5 and 12 were essentially obliterated by the county road construction activity.

The areas of spring flow could be characterized as important to numerous species of songbirds, since an obvious increase in numbers of doves, woodpeckers, spotted sandpipers, kingbirds, warblers and other small bird species were seen in the areas of springs, but were not apparent in other areas of the drainage bottom that did not have spring flows. A great horned owl was photographed perching just below spring number 7.

It would not be unusual for great numbers of bird species to be associated with spring flows since the increased water availability to plants and birds would tend to increase cover and provide a suitable micro habitat and edge effect with nonspring areas to support a great variety of species.

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Westmoreland's Application #00068
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The importance of the spring ponds to amphibians is obvious and, without the ponds, the amphibians would be lost in the area, except for times of ponding from runoff water. The loss of these species may be very important to preadators utilizing them as a prey base. Loss of the ponds will also reduce insect populations with resultant negative impact on insectivorous species.

Loss of the ponds associated with the springs will also effect nesting species which require the dense, marsh type vegetation and/or open water near nest sites. Duck eggs were found near spring number 11 by hydrologists this year, pointing to use of these ponds.

Observation data of turkey populations in the mine area show utilization of the specific spring drainage areas by turkey populations during three of four seasons, but no direct correlation is made between spring areas and turkeys in this area. It is assumed that turkeys utilize the dense cover associated with the spring drainage bottoms for escape, nesting and loafing cover.

During the inspection, whitetail deer were spotted two times at springs number 9 and number 10. In both cases, the deer were surprised from beds associated with moist, bottom vegetation around springs. Numerous bedding sites were found around springs number 9 and number 10, pointing to heavy use of these areas by whitetail deer. It is interesting to note that data derived from Pete Martin's 1975 study of Sarpy Creek turned up the majority of all whitetail observations as occurring near this area of spring concentration. I am sure there is a positive selection and need for the closed canopy in conjunction with moist, dense, bottom vegetation found in conjunction with these springs. From Westmoreland's 1978 study, the whitetail deer appear to migrate to the drainage bottoms during spring and summer months to make use of typical whitetail cover associated with drainage bottoms and moist sites found around springs. A statement made by Westmoreland in the 1978 study: "Typically, whitetail deer are associated with lowland creek bottom types however, the upland drainages of Sarpy Creek provide dense vegetation utilized for loafing, fawn rearing and escape cover", addresses the upper drainage areas of springs number 9 and 10.

The above observations point to the importance of the springs in relation to the drainage bottoms concerning wildlife. The dewatering of these springs would have a very detrimental effect on various wildlife species in the Sarpy Creek drainage. The presence of the springs appears to provide an uncommon arrangement of dispersed water sources, both in pond from and marsh form, which in turn provide essential habitat for several wildlife species.

This situation is addressed in Section 82-4-227, subsection (2), (a), (b) and (c) of the Act. The area of the drainage bottoms in conjunction with the springs are highly productive biologically. The loss of present surface and subsurface water in the drainages, as it now exists, will, without a doubt, eliminate certain species in this area. This represents extreme jeopardy to these species.

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Westmoreland's Application 00068
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The loss of the springs would cause a diminishment of wildlife diversity in this area. Such diminishment would not return with successful reclamation off-site unless the water returns to the area as it now exists. It is assured that the area will not return to its former ecological role if the springs are lost or significantly diminished.

The area may contain ecological importance for some species, especially whitetail, turkey and songbirds such that temporary effects associated with spring loss could have a system-wide (Sarpy area) impact. This projection is based upon the use of this area during certain seasons by species not widely dispursed throughout the system.

lw

APPENDIX D.--Individuals contributing to preparation of this EIS

Cheney, Patrick, Editor, Department of State Lands
- B.A. English, University of Montana, 1972
- M.A. English, University of Toronto, 1974
- Ph.D. English, University of Toronto, 1979

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- M.S. Botany, Montana State University, 1976

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Stiller, David, Consulting Hydrologist
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- M.A. Physical Geography-Geology, University of Wyoming, 1975
- Ph.D. Candidate, Physical Geography, University of Calgary, 1979

Swain, Walter, Soils Specialist, NPRB EIS Team
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- M.S. Forest Soils, University of Washington, 1975

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- M.S. Environmental Studies, University of Montana, 1976

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